UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

IMPLEMENTATION OF AGILE METHODOLOGY IN THE SERVICE INDUSTRY DURING THE COVID-19 PANDEMICS

Ljubljana, February 2022   DRAGAN SRBINOSKI

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LIST OF ABBREVIATIONS

PMM – Project Management Methodology

XP – Extreme Programing

IPMA – International Project Management Association

PMI – Project Management Institute

APM – Agile Project Management

PERT – Program Evaluation Review Technique

CPM – Critical Path Method

WIP – Work in Progres

SAMI – Sidky Agile Measurement Index

INTRODUCTION

Nowadays, the task of managing projects in different business companies and organisations, as entities on their own, is of paramount importance. Indeed, modern businesses face much more aggressive competition, compared to their past business endeavours, owing to the turbulent business environment in which they all operate (Azzopardi, 2021). To remain competitive in business and to achieve the required high performance, they need to find their own distinct way to manage their projects. Failure to adopt a successful project management methodology (hereafter: PMM) could jeopardise and compromise business efforts and overall effectiveness, in terms of knowledgeable management, repeatability, comparability, quality, and future impact (Ozmen, 2013). Since project management is constantly evolving and improving in the course of the time, entities need to adapt as quickly as possible.

It is a commonplace that the right choice of PMM is becoming ever more important (Burgan, & Burgan, 2014). The traditional approach to project management is based on a fully detailed project plan that is strictly put forward. The product is delivered at the end once the project plan has been fully implemented. Some of the known traditional PMM are CPM, PMBoK and PRINCE2 (Depaire, 2019). One of the modern methodologies in project management in the course of the last thirty years would be the emergence of the so-called agile methodology. Unlike the traditional approach, agile methodologies involve planning in iterations (Dey, 2020). The use of agile PMM has proliferated over the last twenty years ever since the document Agile Manifesto was written in 2001. Agile project management emphasises flexibility as an iterative and adaptive approach, emphasising short, customer-focused feedback loops, self-organising and interdisciplinary teams, transparency about engagement and activity progress, face-to-face communication (Dey, 2020), (Schmidtner, Doering, & Timinger, 2021). Teams are guided by the principles of delivering results incrementally, step-by-step, along with an increase in innovative product features, prioritisation of work as per need, and iterative implementation of the project in compliance with the user's vision and feedback (Beck et al, 2001). Some of the most important agile methodologies include: SCRUM, Kanban, Extreme Programming (hereafter: XP), and Lean.

By and large, an entity agility is demonstrated by its ability to proactively adapt to uncertainty so that the company or the organisation could precipitously respond to changes across the value chain to become aware of the present business opportunities. The ability to deal with complexity, uncertainty and change is one of the core strengths of the agile project management approach (Schmidtner, Doering, & Timinger, 2021).

The global spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has already reached pandemic proportions and is affecting all countries, be they poor or wealthy. The rapid blow-out of this contagious disease has different economics impacts on the service industry as well. However, even those entities which have not suffered substantial financial losses and fiascos have faced challenges and uncertainties. Indeed, all entities are

forced to consider innovative products and services during the pandemic in a dynamic rapidly-growing market. In addition to highly competitive industries and economies, entities around the world also face new challenges, posed by the Covid-19 ominous pandemic. Entities must prioritise the needs of their employees in a hierarchical manner while maintaining business continuity in unusual market circumstances. At a time of this global pandemic, entities are still trying to cope with the market situations, to continue to operate and maintain their set position in the markets, to find new markets by developing new products or services, and make or seek potential investments, etc. Moreover, the global pandemic brought into focus the decline of legacy services and accelerated the transition to digital entertainment and to different communication habits. It has also changed the "landscape of work" and the way we do our daily work. The pandemic also brought about numerous uncertainties regarding project contracts, customer response to the pandemic, the team's ability to work remotely, the infrastructure to be deployed, and suppliers' work (de Camara, et al., 2020).

According to Camara et al. (2020) the main challenges during the pandemic were maintaining team productivity, defining the tools needed to manage the remote work, aligning expectations with those of customers, continue to deliver value through cycles, maintaining employee well-being, providing the necessary infrastructure for all employees, and coordinating the development process. Consequently, organisations struggle to find new ways to cope with these new challenges. Rapid changes in the business environment constantly add turbulence to the planning and decision-making processes in businesses. Hence, it is the agile approaches that could help them respond to the uncertainty caused by the Covid-19 pandemics.

However, entities face challenges when trying to adapt their PMM from a waterfall to an agile framework in order to "stay on-board" in the rapidly changing environment. Adapting the agile mind-set has posed a lot of challenges on everyone in a company. Therefore, in my master's thesis, I want to examine how part of the service industry is adhering to the agile principles and whether they implement agile approaches when confronted with a pandemic in order to make it easier for them to rise to the challenges mentioned above.

The purpose of this research paper is to understand the level of agility in project teams and the impact of the Covid-19 pandemic on the implementation of agile methodology in the service industry. This research is intended to provide resourceful insights that might help different organisations in the service industry to improve the way they work in an uncertain environment caused by the unpredictable Covid-19 pandemic. Additionally, my research objective is to thoroughly examine the level of implementation of agile principles by a project team in a service industry for part of companies doing business in North Macedonia, and to understand how the project teams in these service industry organisations have responded to the implementation of agile practices under uncertainties caused by Covid-19 pandemic.

The main premise of the thesis is that Covid-19 pandemic influences the implementation of the agile methodology. The research questions that arise from this premise are as follows:

- Q1: What is the level of implementation of agility or agile principles in the service industry?

- Q2: What impact has Covid-19 had on the implementation of agile practices?

For the theoretical part of the thesis, I will mainly rely on literature from foreign authors and articles with international recognition, related to project management and agile methodology. I will review the relevant scientific literature to present theoretical findings regarding agile methodologies, assessment of agile adaptation in teams and organisations and the influence of Covid-19 pandemic on agile methodology adoption. In the empirical part of the master thesis I will present the results of a primary survey of teams working in service industry organisations. The survey was conducted on employees in the service industry organisations in the Republic of North Macedonia. The survey was taken in order to collect more relevant information on how teams manage projects in an agile manner, no matter whether they had previously used agile approaches to manage their projects or not, and a few questions about the influence of Covid-19 pandemic on their intention to use agile approaches and practices and how the pandemic has influenced their way of working.

1 PROJECT MANAGEMENT

1.1 Definition of project management

When it comes to defining a project, a few working definition of the term *project* in the literature can be found. The Project Management Institute (hereafter: PMI) outlines a project as a temporary endeavour undertaken to create a unique product, service or result. The impermanent nature of projects indicates a definite beginning and end. The end is reached when the project objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists (PMI 2013, p. 2).

More specific definition of a project is provided by the PRINCE2 standard, which states that a project is "a management environment that is created for the purpose of delivering one or more business products according to a specified business case" (Matos & Lopes 2013, p.2). It is also worth mentioning that the Association of Project Management defines a project as a unique, transient endeavour, undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes or benefits (Association of Project Management, 2012, p.12).

I maintain that projects by definition are short term events, hence in these environments interactions and involvements are not indefinite. By all means, a project is considered a successful one providing it has been finished in due time, the total cost has not exceeded the

intended budget, all the initial goals have been accomplished, and the client has approved its outcome (Eduard-Gabriel et al. 2017). Projects can create unpredictability and require managers and project teams to be flexible to rapidly changing project environment. To accomplish this goal, project teams are applying different project management approaches, which I will describe in more detail in chapter 2.

There are also several precise definitions of the term "project management" in the relevant reference literature. For instance, PMBoK (PMI 2013, p. 5) defines the occurance of project management as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" whereas the Association for Project Management (2012) alternatively defines it as "the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters." Each project management has its own final deliverables that are constrained to a finite timescale and an approved budget. Here, we are able to see that the definitions of project management are similar between the PMBoK and the Association for Project Management, so for the purpose of this master thesis the definition, as given by PMBOK, will be considered as a reference point i.e. foundation when referring to the term "project management."

When managing a project, a project manager should be well aware of several competing project constraints, which have to be taken into close consideration. In terms of any mainstream project management these constraints are: time, budget and scope. In fact, this restraining triangle is recognised as "the iron triangle" of project management constraints (Atkinson, 1999). According to Atkinson (1999), the first restraint "time" refers to the amount of time required to complete the project successfully, and it is frequently referred to as "the project schedule." The second constraint "budget" or "cost" refers to how much the project will cost to be completed. The third constraint "scope," sometimes referred to as "a specification," is the list of objectives or end results of the project (Atkinson, 1999). PMI (2017) states that there are more competing project constraints, but are not limited to these categories: scope, quality, schedule, budget, resources, and risks. It is also clear that specific project constraints may call for different focus of the project management team. The underlying relationship among the above constrains produces such an impact that the change of one constraint imminently affects the other (PMI, 2017).

Any project in its project management environment can be mapped in a general life cycle as passing through a series of phases, from its start to its end. The sequence of phases is this: commencing the project, organising and preparing its components, carrying out the actual work, and finally ending the project. Projects phases are not fixed for every project. On the contrary, they are determined and progressively added by the project team. Having different phases, the projects life cycle can be predictive, iterative, incremental, adaptive or a hybrid model (PMI, 2017).

The project management methodology especially puts an emphasis on the management of the following ten, so-called knowledge areas: integration, scope, schedule, cost, quality, procurement, resources, communications, risk management and stakeholder management. All ten are identified as realms of the project management, defined by their knowledge requirements, processes, techniques, tools, inputs and outputs (PMI, 2017).

No matter which project management conceptional structure i.e. framework is accepted and operated within, the traditional or the agile one, the core components of the project management consist of: defining the needs of the project, specifying project requirements, the deliverables and their quality, estimating project timeframes and resources, preparing a business case, funding and acquiring stakeholder agreement, management plan development, leading the team of project delivery, monitoring progress, dealing with budget, risks, communication and changes within the project, provider management, and finishing the project with a good result and a happy termination (Association of Project Management, 2012).

Through these core components and well-established principles of the project management, it could be applied to an array of different projects with any degree of complexity and importance (Association for Project Management, 2012). However, this is a challenging task for Project Managers as the change of clients and globalisation add more complexity to projects. Therefore, new and updated methodologies are required for project management (Adesi et al. 2015) and especially within consultancy firms (Cheng et al. 2005).

Several project management methodologies are available for users that could be divided in two major groups: the traditional project management and the newly-emerged agile project management (hereafter: APM) (Depaire, 2019). In the theoretical part below, I will elaborate both the traditional management and the agile management methodology, as well as their comprehension when making a choice between them. In today's new work environment, the traditional management approaches are being replaced by new ones that are more efficient in dynamic and unpredictable environments, such as the agile methodologies (Laanti et al. 2011). Both management approaches will be discussed in greater detail in the following sections.

1.2 History of the project management

Historical accounts offer a revealing look at project management, testifying that it has been around for a very long time that is for thousands of years ago, all the way back to the Egyptian epoch (PMI, 2017). The neat and amazing construction of great structures, such as pyramids, temples, colosseums, cathedrals, railways, bridges, etc. clearly testify that management of projects existed even at the ancient times. Undeniably, long before the project management was formalised as a specific methodology term, the mankind had been involved in a structured and hierarchical managing of projects. These projects were accomplished in a systematic manner with certain similar characteristics to today's projects

(PMI, 2017). Research into the approaches by which these projects were delivered has helped the field of project management by documenting the aspects and practices of project management guidelines. These guidelines provide reliable guidance to project managers inasmuch as they can take full advantage of the earlier practices.

From approximately the 15th century on, large construction projects saw the introduction of engineering aspects to ensure that these projects were completed in due time. Engineering was coming of age as a science and many of the advancements in this field were a result of continual research that was being undertaken (Morris 1994). By the end of the 1930s the world was once more at war, and the US military was striving to produce a nuclear device. This saw the push for expedited nuclear research in the US, and the foundation of the Manhattan Project (Gosling 1999). This was considered an extremely complex undertaking at the time, and whilst this project lacked the management tools and techniques that were to emerge later on in history, it was characterised by a large portion of the underlying principles of planning and directing that make up the basis of the modern project management approaches (Morris 1994).

Seymour & Hussein (2014) maintain that the roots of the modern concept of project management date back to the first half of the 1900s. The two founding fathers of project management (Henri Fayol and Henry Gantt) have set the foundation of project management, as we know it today. During this period of time, Henry Gantt invented the Gantt Chart. Based on their approaches of breaking down work into project-specific tasks and allocating resources, modern theories and project management evolved in almost every area. Overall, modern project management approaches had their origins in two parallel, but distinct problems of planning and controlling in projects in the United States (Seymour & Hussein 2014).

In the 1950s, during the cold war between the US and the Soviet Union, with both countries struggling for nuclear sovereignty and superiority, development of missile programmes accelerated military research and development, so project management tools subsequently received a developmental boost with the advancement of systems management tools - Program Evaluation Review Technique (hereafter: PERT) being one of them (Seymour & Hussein 2014).

PERT was the first procedure that evaluated the time when the project was likely to be finished. Initially, the PERT technique did not take into consideration the constraint "cost." However, the cost feature was later included using the same estimating approach as with the constraint "time." Due to the three estimation scenarios, PERT was found (and still is) to be the best option for projects with a high degree of uncertainty reflecting their level of uniqueness (Seymour & Hussein, 2014).

The second procedure required accurate time and cost estimates. The developed methodology was originally referred to as "project planning and scheduling (PPS)." PPS

required realistic estimates of cost and time, thus it was a more definitive approach compared to PERT. The PPS technique was later developed into the "critical path method" (CPM) that became very popular with the construction industry (Seymour & Hussein, 2014).

It was towards the end of the 1950s that companies began to realise that a project manager was the necessary 'bead in the chain' for a successful management and outcome of projects. These managers had the accountability and obligation of the successful implementation of the project from beginning to end (Stretton 2007), establishing a new role that diverged from the traditional functional management roles. The introduction of the project manager started a shift in the way that projects were viewed by the entire industry. Academics responded by offering several programmes and degrees in project management designed to prepare prospective project managers with the knowledge and tools that could allow them to succeed in project management (Seymour & Hussein, 2014).

The 1960's brought forth the establishment of project management as a separate management discipline, two professional project management associations were set up due to the expansion and major developments in this field. The first one, named the International Project Management Association (hereafter: IPMA), is a European-based association. It was established back in 1965 for providing a logistics support to the most part of European associations which dealt with network planning. The second one, *PMI*, was founded in 1969 in North America. At present, it incorporates the majority members from the USA and Canada (Seymour & Hussein, 2014). Both organisations are active in promoting researches into their field, and produce the peer-reviewed journals, namely the "International journal of project management" by IPMA and the "Project management journal" by PMI. These journals promote the advancement of scientific research into the field of project management (Seymour & Hussein, 2014).

In the course of the 1960s and 1970s, both PERT and CPM increased their popularity within the private and public sectors (Seymour & Hussein, 2014). Defence Departments of various countries, NASA, and large engineering and construction companies, worldwide applied project management principles and tools to manage large-budget, schedule-driven projects (Kwak 2005).

For accomplishing project objectives, the need to hire a project manager was widely recognised, mainly in the construction works, aerospace and defence industries, as these industries involve large scale planning with an intense need of effective project management. (Seymour & Hussein, 2014).

The popularity of these project management tools was enhanced with the development of computers and the associated computer software packages and applications that specialised in project management, but at the very beginning these computer packages were not affordable (Seymour & Hussein, 2014). In the 1980s the use of project management techniques increased with the advent of the personal computer and associated low cost

project management software, and even the manufacturing and software development sectors started to adopt and implement project management practices in lieu of the traditional ones (Seymour & Hussein, 2014). By the 1990s, project management theories, tools and techniques were widely welcomed by different industries and organisations (Kwak 2005).

In the middle of 1990s, various changes in business procedures and practices occured due to the advancement or adoption of internet technology on a global level. This new medium allows for greater efficiency and profitability when doing business, be it remote or at hand, since it helps the project management personnel in handling different aspects of project in a more organised and productive way. It has already been peer-acknowledged that the project management methodologies were adopted due to the "red revolution" in the information technology and communications that took place between 1995 and 2000 (Conrad, 2017).

The project management methodologies are evolving constantly. In the 1960s, project management was largely based around the waterfall techniques. This is a good approach for certain types of projects. But as the world is becoming more complex place for business, we see how project management techniques swiftly adapt to these changes and we realise that not one methodology fits all projects (Conrad, 2017). One of the modern changes in project management over the last 30 years would be the emergence of the agile methodologies. The concept of "agile" is a new mind-set, a big shift from traditional project management, where the project manager has the full control over the project tasks and resources, which are primarily predicted and scheduled, over to new paradigm of self-organising teams that are constantly delivering by focusing on most valuable tasks, prioritised before every iteration (Dey, 2020).

Conrad (2017) has summarised some interesting statements about agility, which I briefly reproduce in the following sentences. According to Crystal Richards, project manager, principal and owner of *Mosaic Resource Group*, the more complex projects have become, the greater the need to be flexible in project management. She restated that some suggest that agile methodology was used to manage projects long before it got its present name. Alan Zucker, founding principal of *Project Management Essentials*, LLC said that "while agile is currently reshaping the face of software development, its roots and practices go back more than 30 years." According to W. Edward Deming's PDSA (Plan-Do-Study-Act) cycle dates back to the 1950s. In his article he cites Chuck Cobb, a 15-year project management veteran and author of *The Project Manager's Guide to Mastering Agile*, who believes that the fundamental approach to project management has not really changed since the space race, and also says that the way we do project management has become more sophisticated, thus making us capable to do larger and more complex projects with more foreseeable results, yet it is all based on a traditional plan-driven approach to project management (Conrad, 2017).

With this in mind, I will briefly discuss the current project management approaches in the following sections.

2 TRADITIONAL PROJECT MANAGEMENT APPROACHES

The Project Management Institute (hereafter: PMI) predicts that nearly 2.2 million new jobs as project-oriented will emerge in the job market each year throughout 2027. The global economy has become more project-oriented, as the practice of project management expands within industries that were traditionally less project-oriented, such as health care, publishing, and professional services (PMI, 2017). As there are more projects to be managed and more complexity within the projects, project managers more than ever turn to proven, effective and reliable methodologies to help them maximise workflow efficiency while staying well-organised. There is no project management approach that works best for all kinds of projects. Although the PMBOK simply specifies the common phases of a project, which is presented as a chronological process, it does not imply any specific framework (Dolan 2007).

The traditional project management approaches were developed for building, car manufacturing and computer engineering industries and are the following (Seymour & Hussein, 2014): waterfall, critical path method (CPM), and critical chain project management (CCPM).

2.1 Waterfall approach

The traditional waterfall project management approach is the oldest and the best-known. The project phases of this model are as follows: analysis, design, development, testing, implementation and maintenance (Bassil, 2012). This approach resembles a waterfall as it goes sequentially one way through the phases. In the analysis phase of the project all the requirements are well-defined. Upon it, in the subsequent design phase, the project team outlines a plan and the project implementation tasks are scheduled and accepted by stakeholders. The outputs of this phase are detailed documents that describe the requirements from the client, as well as all the planned tasks and resources for finishing the project (Kramer, 2018).

When the design phase is finished, then the product development starts in earnest. During the development phase, people on the team build the system, perform unit testing and debugging, and integration testing of the separate units. It has been shown that this phase could be the longest part of the process (Kramer, 2018). At the end, the finished product ought to be ready for the testing in the testing phase. The product is tested against initial requirements. Once the testing of the finished product has been done successfully, in the next implementation phase the product is integrated within other systems and, at the very end, approved by the customer. Right upon the deployment the product enters the maintenance phase (Bassil, 2012). Depending on the final product of the project, the identification of phases, especially the last one, can vary, for instance whether it is a software product or a construction one. In Figure 1, a presentation of subsequent phases in a software development project is shown.

Figure 1: Waterfall approach in a software development project
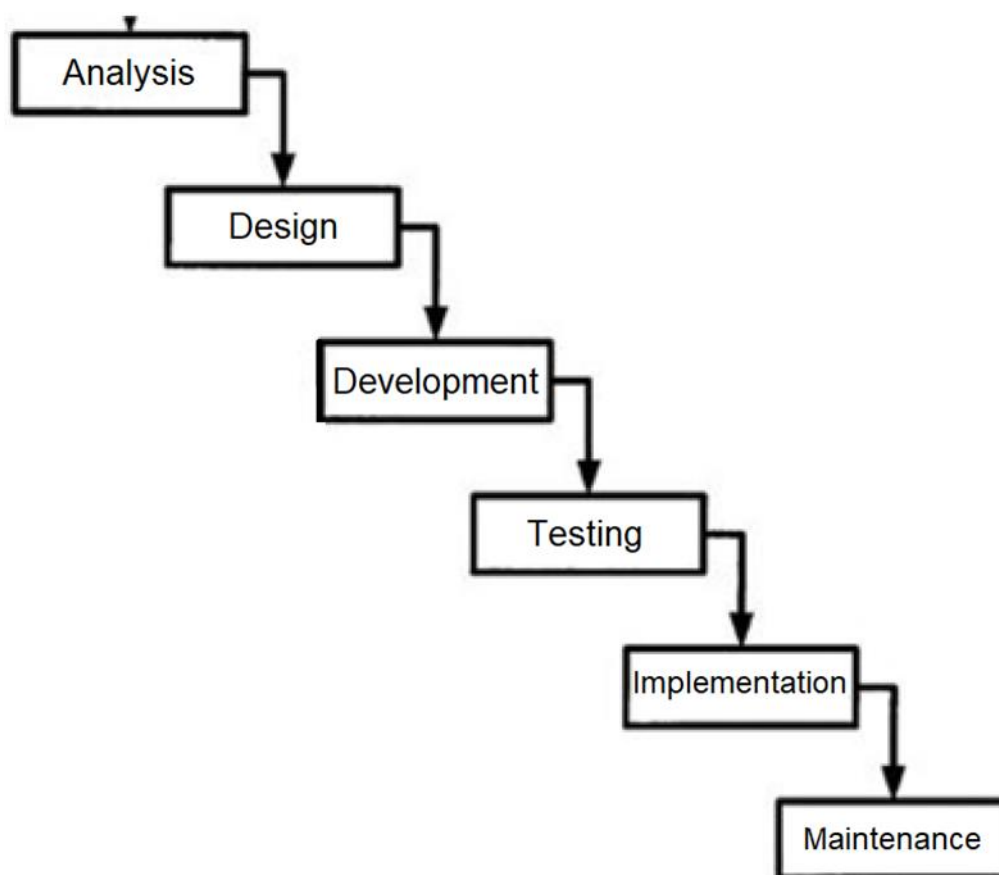
Source: Balaji & Murugaiyan (2012).

In general, as a scholarly example of the traditional project management approach, the waterfall approach works well for projects that are straightforward, predictable, stable (not change-friendly) and quality control is important (Alshamrani & Bahattab 2015). With this approach, projects that have clearly defined project goals and client requirements are managed. The work could be easily done with well-defined assignments given to the team members and recognised resources once the analysis phase has been completed. It fosters an intensive documentation and planning at the early stages of the project. Since the phases are sequential, they are not overlapping one another, meaning that one phase ends so that the next one could begin (Alshamrani & Bahattab 2015).

The aim of the waterfall approach is to complete a project within the planned scope, as the project managers will tweak the allowed budget and the timeframe in order to reach the predicted project result (Špundak 2014).

Due to the above-mentioned features, the pure waterfall approach is not best-fitted for meeting requirements labelled as "changing or uncertain." This model is most useful in structured systems development where altering the software after its coding is strictly prohibited (Alshamrani & Bahattab 2015). On the other hand, it takes a lot of effort in the

analysis and the design phase to collect all the required information, requirements, restraints, exceptions to rules, and to plan all the necessary actions and resources for the project completion. Additionally, the time of delivery of the product or value from the project could frequently take months or even years. The delivery of the value happens mostly at the end of the project (Adenowo & Adenowo 2013).

2.2 Critical Path Method

Critical Path Method (hereafter: CPM) evaluates the shortest path through minimal project duration and scheduling flexibility. The critical path is typically represented by a sequence of activities determined as the path with the shortest duration. The CPM is an effective tool for developing a schedule vital to time management apart from project management. By utilising it, the project manage creates the project schedule, by taking into account the various activities: durations, resources, and constraints as shown in Figure 2 (Kreis et al.2019).

Figure 2: CPM scheduling overview
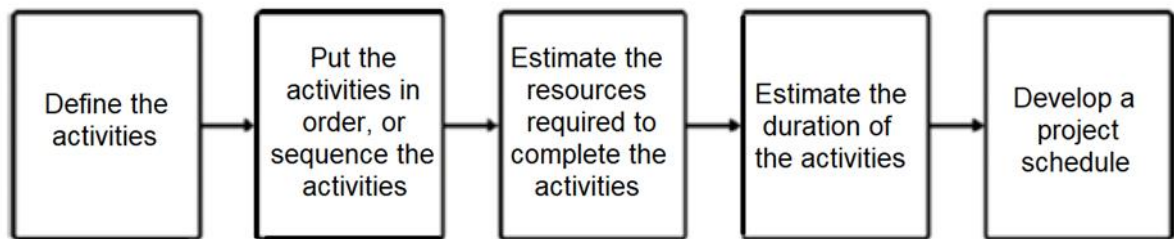
Source: Kreis et al. (2019).

CPM could also determine the amount of schedule flexibility that is known as the "total float," which is the amount of time any project activity might be delayed for, without making an impact on the overall time needed for finishing the project. This approach, which is used to determine the critical path, includes five parameters to be calculated for each activity: the earliest start, the earliest finish, the latest start, the latest finish time, and the total float. In order to get these five parameters, we ought to calculate the so-called forward pass and backward pass (Kreis et al.2019). With the forward pass we are calculating the earliest start and the earliest finish time of each separate task, starting from the task that has no predecessor. The opposite one, adequately named the backward pass calculation, is a similar procedure used to determine the latest start time and the latest finish time, starting from the latest activity. With the CPM, the project manager will identify all the potential paths throughout the project and will highlight the critical path and flexibility already available from the float.

The CPM is widely used in the construction industry and is a standard topic in construction management. Moreover, it is used in most computer software packages for making the

formal work plan for a project. From another point of view, the CPM as a field control tool has never achieved the expected popularity in the construction academic world and in the industry (Senior, 2009).

Nevertheless, the main benefits of the CPM are the following: pinpointing the activities that could run simultaneously, determining the most critical elements of the project, giving a good demonstration of task dependencies, providing a concise procedure for documenting, determining buffer time in the schedule, and providing a good prediction of the project overall duration.

CPM shortcomings are: it does not handle the scheduling of people and other resources, it is a time consuming approach, and it also lacks flexibility when change occurs or re-planning is needed, when it is difficult to change the current plan, and it could also be complicated for sizable projects calculations (Senior, 2009).

2.3 Critical Chain Project Management

The Critical Chain Project Management (CCPM) is a relatively newer one when compared to its counterpart approaches (Ghaffari & Emsley, 2015). It introduces a new mechanism for managing projects uncertainties. It was first was introduced in the scholarly papers by Eliyahu Goldratt as a new approach for managing projects at the International Jonah Conference in 1990 and revision extended the principles of the Theory of Constraints (TOC) to project management in 1997 (Ghaffari & Emsley, 2015). The TOC was based on the principle that every system has a constraint that prevents it from reaching higher levels of performance and the only approach to improve the system performance is to enhance the capacity of that particular constraint. With regard to the CCPM, this unique constraint in single project environments is the longest chain of activities in the project network, taking into account both the activity preference and the resource dependencies (the critical chain). In the opposite case, when planning is done in a multi-project environments, this unique constraint is the release of project around a certain resource (Stratton, 2009).

Goldratt (1984, 1997) provides a five-step procedure for the process of ongoing improvement (identifying the constraint, exploiting the constraint, subordinating other non-constrained entities to the constraint, elevating the constraint, returning to step one if the constraint has been changed). With this procedure, the project manager in charge uses the CCPM to take into consideration all resources, identifies projects constrains, puts them in focus, and makes sure the project is finished successfully.

The CCPM also suggests estimating activity durations to their 50% probability of finishing on time over recognised issue with previous approaches taking task estimates based on 90% probability of competition (Ghaffari & Emsley, 2015). This approach considers a "buffer" (project and feeding buffers) at the end of each chain of activities to allow for time buffer for uncertainties.

When we talk about buffers, there are also some other types of buffers, namely the resource buffer, the drum buffer, the capacity buffer and the cost buffer. Its drawbacks are that it is completely against multitasking, it does not consider activity due dates, and schedules non-constraint activities to their latest start (Ghaffari & Emsley, 2015). Hence, the CCPM is a type of a scheduling approach, which addresses schedule-related aspects of tasks and resources in projects i.e. it is not a holistic approach towards managing projects as it is not related to leadership, project governance and communication. This study will not explain the principles of the CCPM in depth, so for a more comprehensive explanation please refer to the CCPM classic book by Leach (2014).

2.4 The project team in traditional project management

To sum up, the teams in the traditional project management are considered to be individualistic, large in terms of team size, have specialised expertise, hierarchical decision makings as well as less client engagement (Lindsjørn et al. 2016). Therefore, it is evident that such teams are guided through a strong leadership, which is also responsible for decision making and prioritising and delegating tasks. Due to this hierarchical environment, mutual support and interaction among the team members is less present (Lindsjørn et al. 2016). Since all the interaction is more formal, written reports are sent to the project manager. The coordination is achieved through strong leadership i.e. the project manager makes decisions, estimates, prioritises, and delegates tasks. Due to the hierarchical management, any mutual support among the team members is not facilitated. Finally, the focus of team members is not on daily meetings, so the project manager is not protecting them from tasks outside the project. In a word, the project team cohesion and more formal communication are not characteristic of the hierarchical management (Lindsjørn et al. 2016).

3 THE AGILE PROJECT MANAGEMENT METHODOLOGY

As mentioned above, the traditional project management struggles to adapt to the rapid changes in project requirements, stemming either from the client or from the other stakeholders and environment. This leads to longer time needed for production, and even produces unusable or obsolete products, which were the trigger for introduction of the agile project management methodology (hereafter: APM) (Livermore, 2008).

Being 'agile' is defined as the ability to create and respond to change to succeed in an uncertain and turbulent environment (Dey, 2020). The APM in its basics, is an iterative approach that constantly delivers incremental value (Dey, 2020). At the start, it has been devised for managing software development projects. An iteration usually refers to a development cycle in the agile software development.

Before "agile" became so widely-used in the software industry, the *Harvard Business Review* had issued a ground-breaking paper by Professors Hirotaka Takeuchi and Ikujiro

Nonaka in January 1986. It was later used to provide ideas for the formulation of Scrum, an agile framework. Also, several iterative and incremental methodologies appeared, such as the Rapid Application Development (RAD) in 1994-96, and the Extreme Programming (XP) in 1996 (Dey, 2020). The main goal of project management is to successfully manage a project to reach an expected outcome while staying within a specific budget limitations and timeframe. In the agile project management the requirements of the project are delivered in iterations while being flexible and responding to change (Dey, 2020).

Authors, such as Highsmith, argue that "agile" is an umbrella term that covers Scrum, RAD, XP, and other lightweight methodologies, such as Crystal, Lean, Kanban, Feature Driven Development, etc. The term "agile" was introduced in 2001 when seventeen software development enthusiasts, interested in further promotion of customer-oriented techniques, created an alternative to documentation-driven, heavyweight software development processes. They went further to found the Agile Alliance and to write the Agile Manifesto (Highsmith, 2001).

The Manifesto for Agile Software Development is the following (Beck et al. 2001):

We are uncovering better ways of developing software by doing it and helping others to do it. Through this work we have come to value:

− Individuals and interactions over processes and tools.
− Working software over comprehensive documentation.
− Customer collaboration over contract negotiation.
− Responding to change over following a plan.

That is, while there is a certain value in the items on the right, they value the items on the left more.

The same members of the Agile Alliance wrote the 12 Agile Manifesto Principles in order for people to better comprehend the agile software development and to be used as the foundation of agile practices. These principles are given below (Beck et al. 2001).

− Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
− Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
− Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
− Business people and developers must work together daily throughout the project.
− Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

- The most efficient and effective approach of conveying information to and within a development team is face-to-face conversation.
- Working software is the primary measure of progress.
- Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
- Continuous attention to technical excellence and good design enhances agility.
- Simplicity–the art of maximizing the amount of work not done–is essential.
- The best architectures, requirements, and designs emerge from self-organizing teams.
- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

There are five stages of the APM according to Highsmith (2004):

- The 'envision stage' (refers to how to determine the product vision, the project objectives and constraints, the project community and how the team work together);
- The 'speculate stage' (refers to developing an ability or feature based release plan to deliver on all aspects of the vision);
- The 'explore stage' (refers to planning and delivery project running tested stories in a short iteration, constantly seeking to reduce the risk and uncertainty of the project);
- The 'adapt stage' (reviewing the obtained results, the situation and the teams' performance and adapting as necessary);
- The 'close stage' (refers to concluding the project and passing on the key learning's').

The majority of agile approaches allow for early testing of ideas and prototyping, which might be either rejected or improved upon. It could allow for rapid identification and adjustment of issues in the project's early iterations. This engages the people working on the project and builds accountability and empowerment. Agile also puts great emphasis on extensive communication to allow for more effective and teams with self-organising capability, and is also enhancing continuous improvement. All this could lead to much higher productivity (Association for Project Management, 2012).

In the agile methodologies the focus is more on team members rather than on processes and procedures themselves. The customer involvement is greater, which allows for frequent changes at every iteration upon request, and changes are not seen as a disruption of the plan (Dey, 2020).

Agile has become a brand new mind-set that needs to be adopted by all the companies, and not just by the project team. In the agile management approach, the time and resources are fixed whereas the scope varies. Changes of the requirements are affirmed too, which emphasises the flexibility (Dey, 2020).

To be sure, the agile methodologies are not the best project management approaches for all types of projects. In fact, in particular cases a hybrid agile-traditional approach would be

more suitable. Choosing the right approach to managing a project is heavily dependent on the organisational culture, the type of the project and the goals of the project (Association for Project Management, 2012). According to Digital.ai Annual Report (2020) the key five reasons for adopting the agile methodology are these: accelerating software delivery, enhancing the ability to manage changing priorities, increasing productivity, improving business & IT alignment and enhancing software quality.

The negative side of the agile approach is that it could lead to an unclear project image as this may become a big concern for the stakeholders. This is mitigated by having regular meetings to manage and communicate the priority of most valuable items in the project (Association for Project Management, 2012).

3.1 Agile methodologies in practice

Even though APM methodologies are developed primarily for software development projects a number of researchers state that they can be successful if applied on non-software projects and even in non-development areas of organisations processes that are existing in a dynamic and unpredictable environment (Conforto et al. 2014). Many researchers, state that APM approaches could be similarly successful in non-software organisations, which also are surrounded by dynamic environments or projects that demand flexible management practices (Conforto et al. 2014). Other concluded that job satisfaction in agile teams was increased due to teams having the ability to work in interesting projects and be involved in decision-makings (Tripp, Riemenschneider & Thatcher 2016).

Most applied agile methodologies are Scrum, Kanban, XP, Lean and a few hybrid forms based on Scrum, like ScrumBan and Scrum/XP. Most of the research of academics on agile frameworks has been focused on these agile frameworks. They all relay on agile principles and have similar features, some of them even merge their features between each other and thus become new frameworks altogether. The most used methodology is Scrum with its hybrid forms (Digital ai, 2020). In the following subsections I will present a brief overview of most common agile approaches.

3.1.1 Scrum

Scrum is a commonly used agile framework that is guiding teams to develop valuable product or service in an iterative and incremental delivery while continuously inspecting and adopting the process (Anwer, Aftab, Shah, & Waheed, 2017). Scrum essentially is an empirical process that makes teams to respond effectively and efficiently in the rapidly changing environment. As pointed out above, the traditional project management approaches are fixing the requirements to be able to correspond to time and cost, Scrum is fixing time and budget to be able to control requirements. Scrum is based on a ground-breaking 1986 paper written by Hirotaka Takeuchi and Ikujiro Nonaka.

Figure 3: Scrum framework
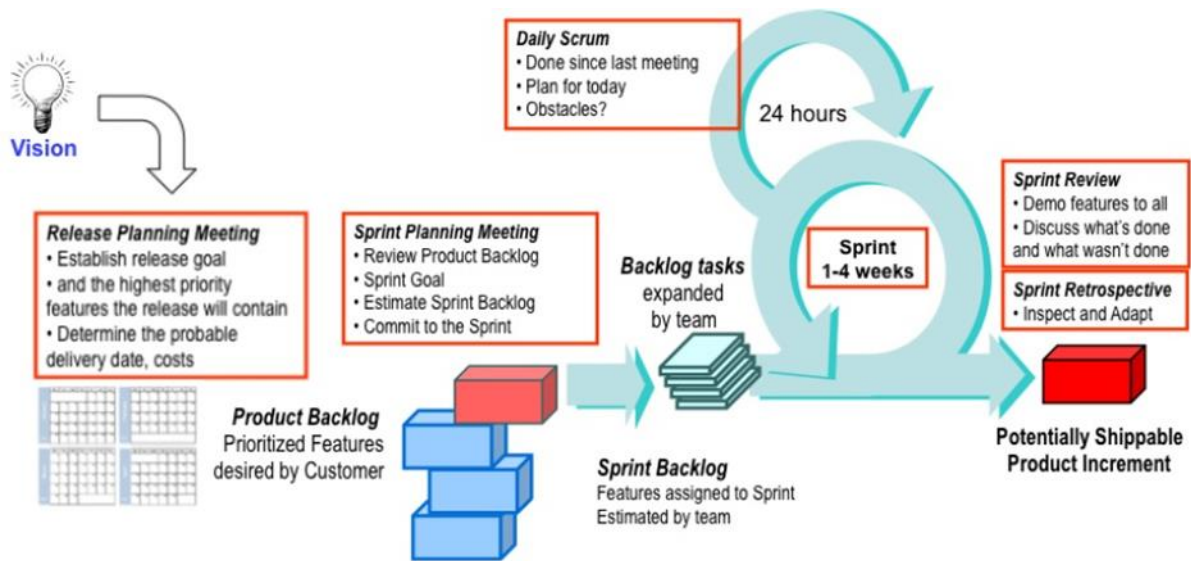
Source: Sliger (2011).

Their ideas were first used by Mike Beedle, Ken Schwaber and Jeff Sutherland in the *Easel Corporation* in 1993. The term "Scrum" stems from a rugby term, used for restarting a play. It is an abbreviation from scrummage, transferred sense of a noisy throng, tumultuous crowd or a rabble.

These authors wrote about their real experiences in the books titled *Agile Software Development with Scrum* (2002) and *Agile Project Management with Scrum* (2004) (Sliger, 2011).

Scrum is providing a basis for delivery, yet it does not imply usage of specific practices, as it leaves to the team to choose what is best for the project. Figure 3 shows the basic Scrum framework.

The Scrum framework has defined team roles, events and artefacts.

Three different roles are identified as team roles (Sliger 2011, Cervone 2011). Product Owner also known as 'the voice of the customer', is responsible for representing the customer needs. He is responsible for the product vision and for translating the product requirements into user stories. Through transparent daily communication with the team, the customer and stakeholders, he determines the final value of the product and strives for the best possible results. The Product Owner owns the product backlog and has the authority to make decisions regarding the product and its backlog. The Scrum Master is a servant leader in the team, helping the team to achieve the goals of the project. He removes all the obstacles so as to help the team to have a productive work environment. He is also responsible to ensure that team adheres to the agile values and principles and maintains Scrum processes and procedures.

The Scrum Master role in a project is to protect the team and not to work on the development of the product. The Development Team is responsible for delivering a potentially marketable product at the end of each sprint in the sense of Definition of Done. The Development Team is self-organised, owns the estimates, plan commitments, daily reports and chooses the best way to reach the initial project goals. Its members are committed to transforming user's demands into a functional product, which is the goal of every teamwork. On average, the team consists of 5-9 members who work together within the sprint and share the responsibility to deliver the product increment at the end of a successful product.

The Scrum framework has a set of specific events as well. The Scrum project begins with a product vision and a set of features provided by the customer representative. As said above, these features are rendered into user stories, a non-technical explanation of needs, telling "what and why is requested." The first event is the Sprint Planning meeting where Product Owner presents the prioritised list of user stories. Then the Development Team grasps the most important stories broken into tasks. In this gathering, the Development Team plans and commits which user-story related tasks they believe could be completed in the next iteration or sprint, depending on their capacity. That list of committed tasks is a Scrum artefact known as Sprint Backlog List. Sprints are time-boxed repeating iterations generally lasting from 1 to 2 fortnights, fixed throughout the project. In the time period of the sprint, the team works together on the committed tasks and is focused on reaching the sprint goal. No changes in the sprint backlog are allowed. A change could be made in the task priority for the next sprint.

The most relevant user stories are constantly prioritised as part of other Scrum artefact, the product backlog, as a list of all unfinished user stories (Sliger 2011, Cervone 2011).

At the time of sprint, the team has another Scrum event every single day i.e. a Daily Stand-up meeting lasting about 15 minutes. The team members take turns to stand up and state what he/she did yesterday, which task is planned to be finished the current day, and which impediment is blocking their way. The main purpose of this meeting is to track the progress of the team and the Scrum Master has the responsibility to deal with the interferences and to make it possible for the team to finish the tasks committed. At the end of the sprint in a Scrum event, at the Sprint Review meeting the Development Team presents to the product owner, the customer and the stakeholders what has been accomplished so far. At the same time, the team gets feedback that could influence their work in the next sprint (Sliger 2011, Cervone 2011).

Additional Scrum artefact is the Sprint Retrospective meeting, at which only the team members are present in order to reflect on the processes and the way they worked in the last sprint. The main goal of this meeting is to learn how to improve step-by-step. They focus on transparency, inspection and adaptation, which are known as Scrum three pillars (Sliger 2011, Cervone 2011).

All the way through the sprints the team tracks the progress of the tasks for each user-story on a task board. The team uses at least three columns named: to do, doing and done. At the Daily Scrum meeting, the team moves the tasks across the columns on the board. The team can add more columns as per need, as shown in Figure 4.

Another effective tool is the Burn Down Chart, which shows the amount of work and the trend line of the work finished in the sprint, as shown in Figure 5.

The Sprint progress is closely monitored on the burn down chart, on the task board and at the Daily Stand-up meeting. Based on this information the Scrum Master takes appropriate actions to ensure successful completion of the current sprint (Sliger 2011, Cervone 2011).

The Release Planning meeting is also one of the Scrum planning tools. At this type of meeting the Product Owner presents to the team user-stories that he/she expects to be done in a stream of consecutive sprints. Quarterly releases are usually planned, focused on the increments of value to the customer. In some cases, release planning can be cost-driven, with a portion of what can be delivered for the specified budget, or feature-driven, certain features need to be done up to planned release (Sliger, 2011). The Product Owner is bound to keep the Release Plan up to date (Sliger, 2011).

Figure 4: Scrum Task Board Example

Source: Sliger (2011).

Figure 5: Sprint burndown chart example
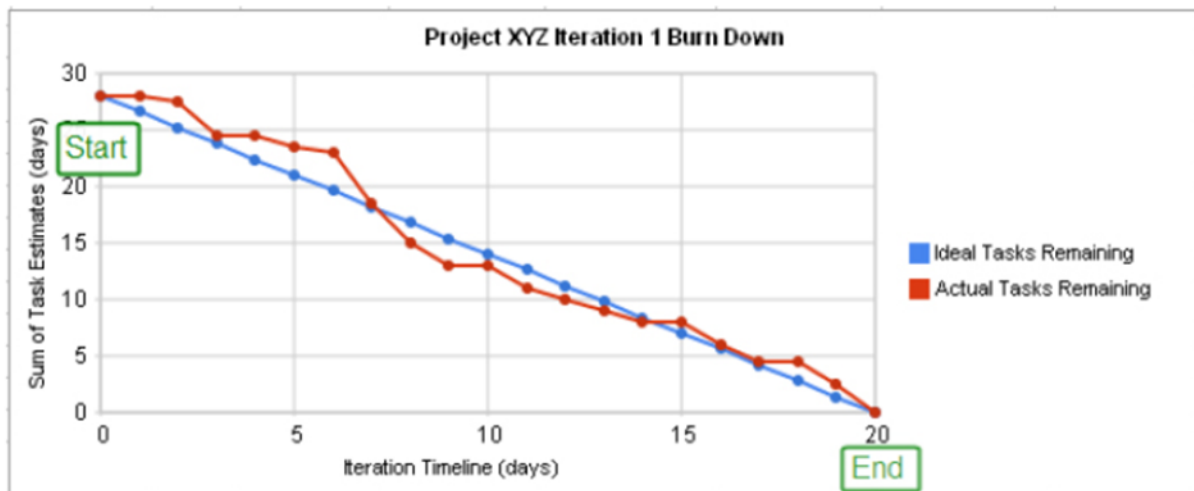
Source: Sliger (2011).

3.1.2 Extreme Programming

Extreme Programing (hereafter: XP) is a well-known agile software development framework that focuses on producing higher quality software and higher quality of the life of the team. It was introduced by the software engineer, Kent Beck, in 1996 (Anwer, Aftab, Shah, & Waheed, 2017). XP emphasises teamwork: in his opinion, stakeholders, customers, and the development team are all equal partners in a collaborative team, by instigating a simple and effective environment, expecting the values and simple practices to be followed, which will enable teams to become highly productive. The team self-organises around the problem that needs to be solved as efficiently as possible. (Agile Alliance, 2021)

The five values of XP are as follows (Anwer, Aftab, Shah, & Waheed, 2017):

− Communication: team and customer constantly communicate in person.
− Simplicity: keep the design simple and clean.
− Feedback: test the software from day one and get constant feedback from the customer by delivering the product as early as possible.
− Respect: each team member deserves respect, has their own standpoints, contributes to the team work, and respects the expertise of the customers. Management respects team's right to accept responsibility and have ownership over their work.
− Courage: always tell the truth about progress and estimates, do not fear anything because no one ever works alone and the team will courageously respond to changing requirements and technology, whenever and wherever they are made.

This methodology proposes 12 practices which are expected to be followed (Jeffries, 1998):

- The Planning Game: predicting what can be finished by some due date and prioritises what to do next.
- Small Releases: the team releases running, tested and valuable software to the customer in every iteration.
- Metaphor: team develop a common vision and system names that will make sure everyone understands of how the program works and where to look and put the functionality of the system.
- Simple Design: simple but always adequate design, software always ready for next feature.
- Testing: test-driven development over constant testing of the system as improvements and new features are added. Team builds automated acceptance test cases as per customer requirements.
- Refactoring: design improvement is in focus in every iteration.
- Pair Programming: all production software to be developed in pair by two team members sitting side by side, at the same workstation.
- Collective Code Ownership: any group of developers can improve or add any part of the code at any time.
- Continuous Integration: the team keeps the system fully integrated, with all new features integrated on a daily basis.
- Sustainable Pace: 40-hour week, working overtime only if necessary.
- On-site Customer: he/she is part of the whole team.
- Coding Standard: all the code looks like it was written by a single man although it is owned by the whole team.

Anwer et al. (2017) argue that roles in the XP are not strictly established and sometimes some of them are not even present when using this methodology: customer, developer, tracker, consultant, big boss and coach. The customer is one or more representatives of the project requestor, heavily involved in the process of creation of user-stories, acceptance criteria, budget constraints, prioritisation and the risk analysis for these. Developers are team members with mixed abilities and skills, and they communicate directly with customers as well as develop what is planned for the next iteration. Tracker is usually some of the developers that have additional task to keep track of some necessary metrics for the team and to adequately present them. The consultant is present in some cases for technical guidance when needed. The big boss is a person that is providing necessary resources and everything that is needed for the team. The coach is a role usually given in teams that are starting to work by XP methodology or have some members who are new in the methodology (Anwer, Aftab, Shah, & Waheed, 2017).

The XP development process has six phases as follows: exploration, planning, iteration-to-release, productionising, maintenance and death phase (Abrahamsson, Salo, Ronkainen, & Warsta, 2017), as shown in Figure 6.

Figure 6: Life cycle of extreme programming
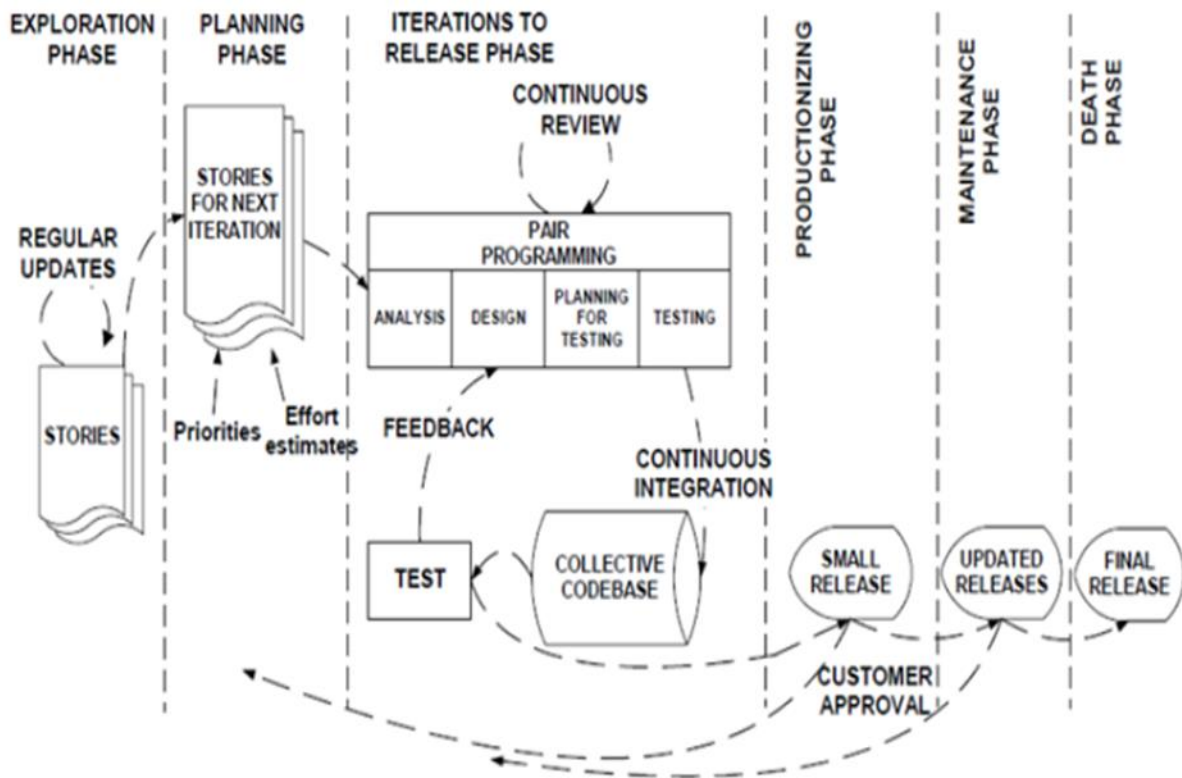
Source: Abrahamsson, Salo, Ronkainen & Warsta (2017).

In *the exploration phase* requirements from the customer are translated to user- stories, defining the features and functionalities of the system. User-stories are time estimated on needed development effort by the team such that each story gets defined acceptance criteria by the customer. In *the planning phase*, developers along with the customer are prioritising work in iterations while taking into consideration workload and value that adds each of the user-stories.

The user-stories, for which the team is unable to estimate the workload needed, they have Spikes, which are short, separate, time-boxed meetings, serving as benchmarks to clarify further what the needs are. Upon such meetings, the entire team creates acceptable release plan (Anwer, Aftab, Shah, & Waheed, 2017).

Then ensues *the iteration-to-release phase* when the team breaks the workload into a series of weekly iteration cycles, as shown in Figure 6. Prior to each weekly iteration cycle, the team and the customer have a meeting to decide on which stories should be developed in the course of the upcoming iteration. Then, the team breaks chosen stories into development tasks. A common agreement about the tasks that will fit into the next iteration needs to get a go-ahead by the whole team. It may take up to several iterations to reach the release delivery phase and get the customer approval. At the conclusion of the cycle, the team and customer are reviewing the headway made up-to-date. At this Review meeting it is left to the customer to decide whether the value is acceptable, should the project be continued or it requires

additional change to be incorporated. After obtaining a small release of software ready for production, in the production phase the software passes the acceptance test, and is ready to be implemented in the production process. The following *maintenance phase* is a natural phenomenon of software products. Although the team can freely add new features in this phase, it needs to be more careful as the system is already in production. *The death phase* is the last XP phase which the software reaches as it features all the needed functions including a small documentation.

In other cases, the death phase can be reached if there are some last features cancelled by the customer as they are too expensive to be developed (Anwer, Aftab, Shah, & Waheed, 2017).

However, the XP has also shown some drawbacks, such as: less focus on design, poor architectural structure and lack of documentation, which have an undesired impact on its performance. Moreover, its proposed practices *on-site customer* and *pair programming* cannot be applied in every situation (Anwer & Aftab, 2017). These drawbacks make the XP almost unusable for some projects, where these characteristics are most expected and important. Because of its simplicity, best practices and disciplined approach it is considered only applicable to small low-risk projects (Anwer & Aftab, 2017).

3.1.3 Kanban

Kanban is a popular APM methodology which translates to "billboard" or "visual card". It dates back to 1953, when Toyota began optimising its engineering processes to improve efficiency in manufacturing. They aligned their massive inventory levels with the actual consumption materials, as when onsite stock was used, a card, "Kanban," was passed to the warehouse to restock. This process, called "just in time," is part of Kanban even today (Agile Alliance 2021).

The main practices of Kanban are as follows (Agile Alliance 2021, Alqudah & Razali, 2017):

−	Visualize the workflow: using mechanisms as a Kanban board team is visualizing project tasks and its flow, policies per particular stage and work in progress (hereafter: WIP).
−	Limit WIP: with given limits of how many tasks can be in progress at a given timeframe.
−	Managing flow: maximising value delivery through prioritising tasks, minimise lead times and easier prediction of workflow, through transparency, inspection and adaptation towards potential bottlenecks and blockers.
−	Make polices explicit: explain a process limits, capacity allocation, definition of done and rules applicable for stages in processes.
−	Implement feedback loops: essential element for managing changes.
−	Improve collaboratively, evolve experimentally: start with the process as of today and continuously and incrementally improve it.

The focus of Kanban is to bring visibility of the project, showing "what and by when" needs to be achieved, by prioritising tasks that may affect the project completion (Alqudah & Razali, 2017).

Figure 7: Life Cycle of Extreme Programming
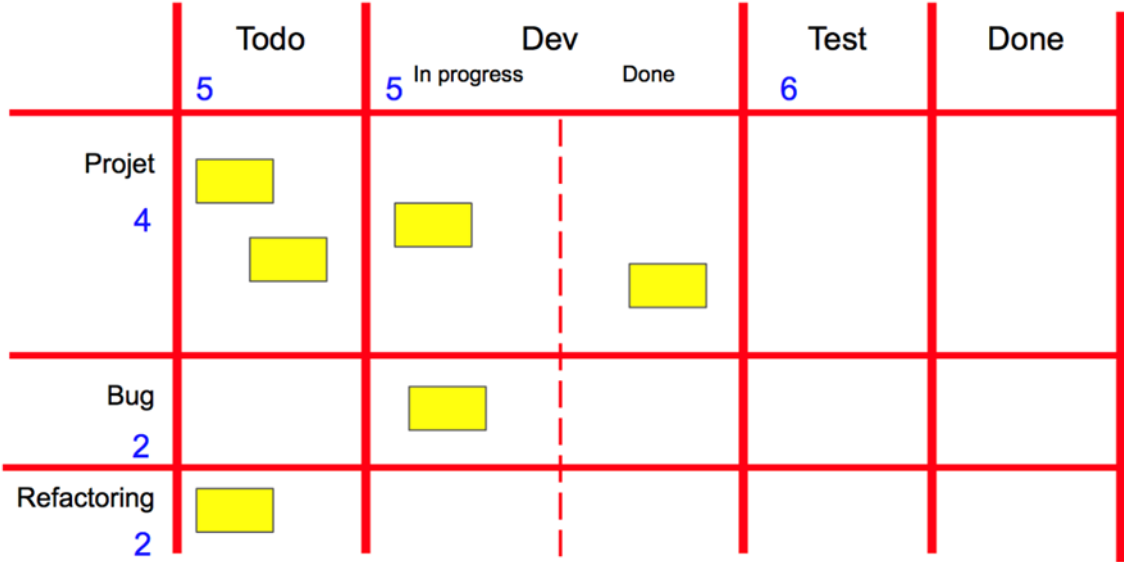
The most representative tool of this methodology is the Kanban board, where processes, goals and project tasks are visualised through their entire flow, by sticking card on a specific place on the board. Visualising the workflow helps tracking of the cost and time, improving team communication, transparency and team productivity by collaboration over pending tasks (Agile Alliance 2021, Alqudah & Razali, 2017). The simplest Kanban board can be divided into three sections: work to be done, work in progress and completed work (Agile Alliance 2021). Additionally, the board has visual signals, work-in-progress limits, a commitment point and a delivery point (Atlassian 2021). Depending on the specifics of the project, teams are arranging the board as per their needs. An illustration of the Kanban board is shown in Figure 7.

I have to point out that the Kanban methodology does not have predefined roles and responsibilities. It is a more flexible methodology when compared to Scrum as it implies a flexible team size and does not have any sprints. This methodology allows prioritisation of newly-arrived requirements, quality improvement and cost cutting (Alqudah and Razali 2018). The Kanban is only suitable for situations where the team has lots of customers, but only few resources, and it is usually combined with other agile approaches.

3.1.4 ScrumBan

The elaborated Scrum and Kanban methodologies are predecessors of the newer hybrid ScrumBan methodology. The ScrumBan is enhancing the weaknesses of one model by replacing it with the strengths of the other (Alqudah and Razali 2018). Hence, teams can adopt practices from one of the approaches which they consider as the most appropriate one. Furthermore, the ScrumBan supports creativity towards developing new methodologies to meet their needs while answering the requirements. The ScrumBan is more adaptive to changes requested by the customer (Alqudah and Razali 2018).

Knowing both the Scrum and Kanban will yield more benefits as well as success in adopting and practicing of their "child" ScrumBan. Furthermore, the ScrumBan focuses more on requirement prioritisation and continuous flows of tasks, then on sprints, and on certain changes that could happen over the course of sprint development. In the ScrumBan there is flexibility of team size, and roles and responsibilities are chosen among the team members without emphasising their specific role in the team. Cost cutting is paid much more attention in the ScrumBan compared to Scrum and Kanban methodologies separately. By the criteria mentioned above, the quality and the success of the project outcome is expected to be higher in the ScrumBan (Alqudah and Razali 2018).

3.1.5 Lean project management

To clear out, projects are considered as "lean" if they minimise waste and maximise value for the customer in the process of delivering the product by optimising value streams, empowering people and continuously improving (Ballard & Howell, 2003). Lean project management has its origins as Lean Manufacturing at Toyota. This type of management has penetrated a lot of industries. According to software development researchers, up to 50% of features in any product do not add value, but rather create unnecessary cost and complexity, thus gradually weakening the product. In the recent years as there is a need to reduce cost, there is more pressure of working more efficiently while reducing the amount of waste being generated (Ebert, Abrahamsson, & Oza, 2012). Through the reduction of waste, costs and production time it is expected quality to be improved. As such, "lean" can be considered as a management philosophy on its own right, also called Lean thinking, so it is applied to other areas and fields, such as project management. From the project management perspective, a project could have a number of potential aspects where waste is present. Most wastes in project management are generated from excesses and unproductivity, such as unproductive meetings, rework, excessive planning and documentation and requirements for features which are expected to be rarely used. Lean project management aims to eliminate these types of wastes (Ebert, Abrahamsson, & Oza, 2012).

According to Standish Group Study (1996), only 7% of features were always used, another 13% were often used, 16% were sometimes used, 19% were rarely used, and 45% were never used.
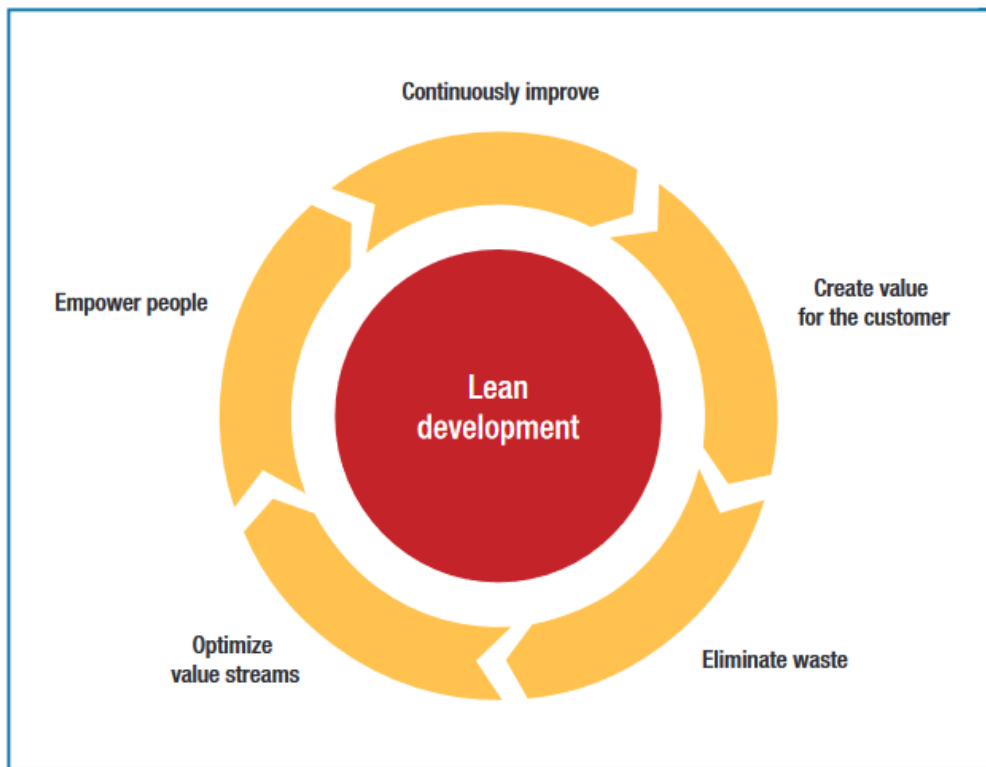
Lean thinking has 5 core principles as identified in the Lean thinking book. The 5 principles are: create value from customer's point of view, identifying the value stream and eliminating waste, optimising value streams for the customer, involving and empowering people, and lastly Kaizen i.e. continuously improving towards perfection, as shown in Figure 8 (Ebert, Abrahamsson, & Oza, 2012).

3.1.6 Agile-waterfall hybrid approach

Instead of taking a fully traditional waterfall approach or a fully agile approach to project management, there is often a need and opportunity to utilise a hybrid approach by combining specific aspects of both traditional and agile project management. The feasibility of different approaches to project management are heavily dependent on the organisational structure and culture and whether there is a possibility of coexistence and fitting in within the organisations current project management models (Conforto & Amaral, 2016). Especially in more large, complex organisations which are dealing with large scale projects, ideal grounds for adopting a fixed approach to managing projects cannot be always found. In such cases, a more traditional waterfall approach could be used for the beginning stages of a project, namely the planning phase. The planning phase of a project usually requires a careful and methodical approach, in which case a waterfall approach is more suitable. Then, when the project reaches the development phase, aspects of agile can be used to find the solution, such

as developing a set of prioritised requirements in sprints (Association for Project Management, 2012).

3.2 Comparison of traditional and agile approach

Different companies and organisations come across quite a lot of challenges when adjusting their project management methodology (Nuottila, Aaltonen & Kujala 2016). From the traditional waterfall framework they try to adopt towards agile frameworks so as to be able to stay competitive in the rapidly changing environment. In fact, all modern societies face a lot of challenges when trying to adopt the agile mind-set. The most common challenges they are faced with are the following (Nuottila, Aaltonen & Kujala 2016, Nerur, Mahapatra, & Mangalaraj 2005, Hajjdiab, & Taleb, 2011):

- Knowledge sharing and transfer.
- Moving away from developers' attitude to work individually and be micro-managed, collaborating in self-organising teams.
- Coordination among dispersed teams in large-sized projects.
- Establishment of direct i.e. immediate contact with the customer.
- Tendency of the developers to focus on specific tasks rather than on taking a "helicopter view" and trying to grasp the whole picture of the product the customer wants.
- All projects are high priority and they cannot say no to new requests, so they keep starting new projects.
- There are never enough people to do all the work, so they assign and over-allocate their top performers to multiple projects simultaneously.
- They keep churning project teams and starve low priority projects.
- A little bit is done for lots of projects, but only a few projects are actually completed.

It is deemed that organisations with agile experience and project teams have discovered various ways to deal with these challenges (Chow & Cao 2008, Mersino 2016, Lindsjørn, Sjøberg, Dingsøyr, Bergersen & Dybå, 2016).They are as follows:

- Step by step implementation, first in a smaller parts of the organisation, and afterwards in the whole organization.
- Agile coaching for the team.
- Provide examples of successful organisations that have implemented agile.
- Move away from the concept of projects and set up long-term stable teams.
- Create conditions for high-performance in teams.
- Make sure that long-term stable teams work at a sustainable pace.
- Avoid overloading the team.
- Avoid moving people between teams.
- Avoid assigning team members to multiple teams.

Projects with agile project management approach tent to have less failed projects than projects that are more traditionally managed. Data obtained from Standish Group report Chaos Studies (2013 – 2017) show that waterfall managed projects have 21% failure rate against agile managed projects that have low 8% failure rate.

Project managers ought to be well aware that even though project management approach is important, the project size is also an important characteristic. Researchers argue that a large project is 10 times more likely to fail compared to a small project, therefore agile methodologies are intended for smaller projects. (Mersino, 2016). By comparison, data obtained from Standish Group Chaos studies (2013-2017) show that larger projects have higher failure rates. Small waterfall managed projects have success rates of 56% against large projects with only 9% success rate. Agile managed projects have slightly better success rates: for small projects it is 59% whereas for large projects it is 18%.

All above mentioned factors are influential in the direction of increasing the agile knowledge and agile usage. The 14th State of Agile Survey (Digital.ai, 2020) indicates that 95% of respondents reported that their organisations take the Agile development approach. But 82% indicated that not all of the teams in their organisation had adopted Agile practices, indicating that there is still room for growth of agile adoption.

In the survey areas of organisation that have adopted the Agile principles and practices, 63% of non-software development areas adopted Agile. Statistics show that Scrum is the preferred methodology, used by 58% of agile teams. In cases where various Scrum hybrids are included, this number grows to 76% (Digital.ai, 2020).

According to the survey, three top reasons for adopting agile are as follows (Digital.ai, 2020):

− To accelerate software delivery.
− To enhance ability to manage changing priorities.
− To increase productivity.

Three top benefits obtained from implementing Agile are as follows (Digital.ai, 2020):

− Acquired ability to manage changing priorities.
− Improved project visibility.
− Obtained business/IT alignment.

Compared to linear process, iterative incremental development is far more popular and widely applied in software companies (Boehm, 2007). Its main advantage is flexibility, which is very important in terms of highly developed software industry and software technologies (Boehm, 2007). Customers' great expectations move quickly and become unpredictable, that is why sticking to a static plan, as suggested by the Waterfall approach, may lead to frustrating results (Boehm, 2007).

In conclusion, both the traditional and agile approaches have their pluses and minuses. Pluses of a traditional approach are; it is suitable for stable-environment projects with clearly defined requirements; the project and the team can be controlled by milestones and KPI's; and a great number of project plans can be reused in similar projects. Minuses of a traditional approach are: at the start it requires a lot of work to clearly define the scope; changes are slow, risky and could negatively impact the project; and deliverables of the project are mostly at the end. Pluses of an agile approach are: it is suitable for an environment with flexibility of changing requirements and scope, where customer and important stakeholders are strongly involved in the project; there is teamwork collaboration; and there is also an early return on investment because of iterative delivery of value. Minuses of an agile approach include: due to uncertainties, there is a possible risk of negative impacts on timeframe and budget and it might not deliver management benefit or advantage for projects with fixed and predefined scope (Association for Project Management, https://www.apm.org.uk).

The Figure 9 shows the handouts in waterfall approach where all events in previous phase need to be finished to allow for starting of the following phase and the full product is delivered at the end (Alshamrani & Bahattab 2015) whereas in the agile approach the product has been developed and delivered incrementally (Anwer, Aftab, Shah, & Waheed, 2017). The team in the waterfall approach can be different in each phase whereas in the agile approach the entire team is constantly involved through all iterations to the final product delivery as shown in Figure 9 (Dey, 2020).

Figure 9: Waterfall vs agile project management
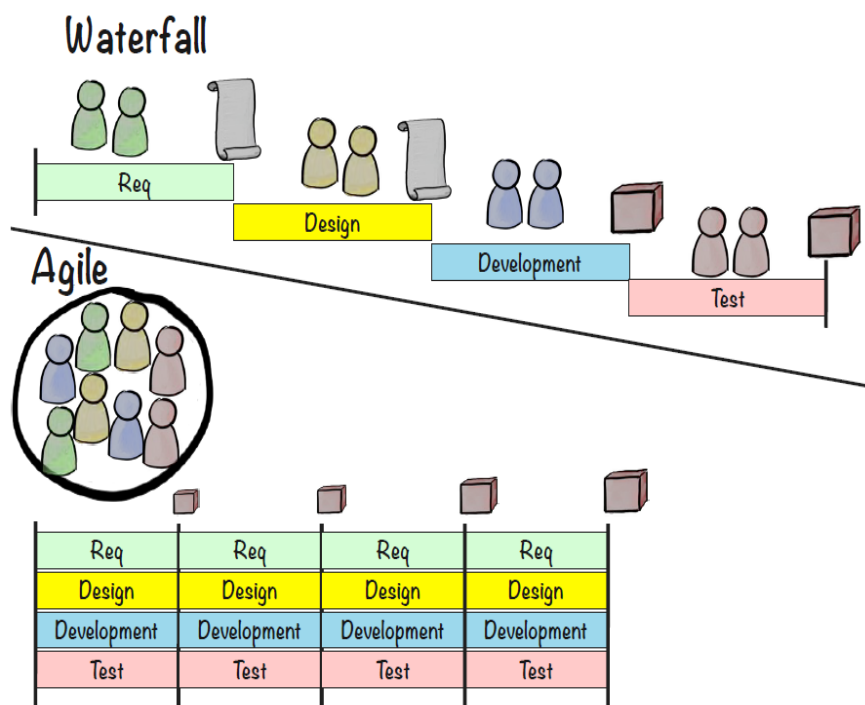
Source: Henrik Kniberg, Agile Lean Slides.

4 SERVICE INDUSTRIES IMPLEMENTING AGILE METHODOLOGIES

The world community's development corresponds to the occurrence of the fourth industrial revolution Schwab (2016) – the founder and President of the World Economic Forum in Davos. Organisations need to adopt to rapidly changing environment. As traditional project management can hardly adapt to the rapid changes in project requirements made by either the client or other stakeholders, the environment is expected to be the trigger for introduction of the APM methodology in organisations (Conforto et al. 2014).

A systematic research effort done by Conforto et al. (2014) in order to collect evidence of the implementation of APM practices, regardless of the project type, or the industrial sector for that matter, showed that most of them are still limited to software development projects. Some authors (e.g., Highsmith, 2004; Chin, 2004) argue, however, that these practices, techniques and tools could be adapted to other types of products and project environments, whose characteristics resemble software projects that are innovative and have a dynamic development environment experiencing constant change (Conforto et al. 2014). They suggested that the APM approach could be adapted to non-software companies, or more traditional industry sectors, at least for innovative projects or even for some parts of the project that require a more flexible management approach. Conforto et all (2014) conclusion is that project management research community should further investigate how to develop "hybrid" management models, considering APM and traditional approaches, in order to balance the "agility" needs and barriers identified (Conforto et al. 2014).

As stated by Ćirić, Gračanin and Cvetković (2017), the APM has been adopted for software development in thousands of companies around the world and it is on the rise, as stated in the *2015 Pulse of the Profession* report, with 38% of responding companies reporting its frequent use, which is 8 percentage points up since the year of 2013. In their survey, the count of organisations using APM in their industry outside of software development is the following: 57 respondents are from the IT sector and the rest come from 17 different non-IT sectors. As stated in their survey, 22% of the respondents used agile project management in their organisation beyond software development and IT-related projects. In the survey they found out that top reasons for introducing APM beyond software development are the following: enhancing ability to manage changing priorities, was ranked as the most important reason, followed by Accelerate project/product delivery, better focus on client, increase productivity and reducing project risk. On the other hand, reducing project cost, enhancing delivery predictability, improving project visibility and improving team morale had the lowest rank. (Ćirić, Gračanin, & Cvetković, 2017).

Based on their relevant literature review and theoretical observations Ćirić, Gračanin, and Cvetković (2017) identified a wave of interest from researchers that discussed the application of the APM and its principles and practices beyond software development projects, yet some of the reviewed papers are based only on assumptions and ideas, so there

is a need for implementation of these ideas into the real-world situations. As believed by these authors, introduction of the APM needs culture shift for organisations, as it is contrary to traditional organisation, to managerial structure and to traditional project management way of operating. It is expected that the APM have potential to offer successful practices to future project management. But there is a need for more rigorous studies to be conducted before any credible advice can be given. (Ćirić, Gračanin, & Cvetković, 2017).

Ćirić and Gračanin (2017) also conducted a systematic literature review concerning the APM applicability beyond software industry and found out that there is a rising interest for APM in construction and real estate development projects. The authors stated that the potential benefits of using the APM in this industries would be improved understanding and implementation of project requirements, improved communication and cooperation between project stakeholders (especially in cooperation with the designer, general contractor, investor and suppliers, which are economically much larger partners), improvements in pre-design and design phases of construction, improved team and project effectiveness, reduction of omissions and reworks, reduction of project time and cost and swift switch between teams on one or more construction sites (Ćirić & Gračanin 2017).

Another segment of the service industries where adoption of the APM is important is the Telecommunications industry. It is a very dynamic industry in which products and services are changed on a daily basis. Great number of telecommunications companies use the agile project management (APM), such as TechCore Inc., by creating a product backlog and by implementing one of the approaches of agile project management – scrum. Upon the APM implementation, they identified a problem with the supply chain and shortened the meetings that often went off track, taking the team a full workday (Balashova, & Gromova, 2017).

The next instance is Telecom Australia, which implemented the scrum in 2012, as they were having problem in project management with differences of definition of done across different technologies. As a result, they enabled the teams to work in a highly-coordinated fashion to refine the features for the next sprints and excellent transparency of the work at all levels (Balashova, & Gromova, 2017).

In 2014, Vodafone Turkey, started agile transformation in three steps: in the first step, a pilot team was established and its progress had been tracked. After being satisfied with the initial results, they started the second step, scaling step, via establishing new scrum teams. About five months later they reported scrum teams' throughput to be twice more than before. In addition, a significant reductions in defect rate and reduction of the customer complaints inside these scrum teams were made. The third step was enterprise adopting with the aim to grow agile culture. The telecommunications industry in Turkey is highly competitive and agile transformation has started to shorten time to market and improve quality in order to be able to provide competitive advantage to the business (Balashova, & Gromova, 2017).

In agreement with Balaban & Đurašković (2021), additional examples of non-software industries are: *John Deere*, which favours the agile approach to develop the new machines, and *Saab* to produce new fighter jets (Rigbi, et al., 2016).

Although the benefits of applying the agile approach are widely known and recognised by managers and employees alike (such as an ability to manage changing priorities, better project visibility, good business/IT alignment, boosted team confidence, increased team productivity, etc.), there are still various challenges and problems that the organisations meet and respond to when adopting the agile practice (Balaban & Đurašković 2021). The main challenges taken on when adopting the agile practice remain general organisation resistance to change, poor leadership and inconsistent processes and practices across teams (Balaban & Đurašković 2021).

4.1 Assessment of agile implementation

Various entities, when embarking on an agile journey, have to choose an appropriate agile assessment that can be used to assess how successful teams (or even organisations) are in implementing the chosen APM approach. After reviewing the relevant literature, I found that all Agile Adoption Frameworks are devised for assessing agility and pinpointing focus areas, which account for headway and visible success. The framework assumes that an entity or a team is agile and wants to assess their level of agility adoption and areas for improvement.

Many scientific researches and commercial questionnaires used for agile implementation assessment are based on agile maturity models, which help the interested parties to implement agile practices. As claimed by Schweigert et al. (2013), about 40 Agile Maturity Models have been published, some of which were developed scientifically, while others are commercial agility assessment tools from consulting companies. However, most of these different agile measurement tools are not statistically validated (Gren, Torkar, & Feldt, 2015).

According to Ozcan-Top and Demirors (2013), Sidky's agile adoption framework is giving the best assessment results. On the other hand, in other study by Jalali et al. (2014) they have tested practitioners with a set of agile measurement models and got a different assessment results. These maturity models guide organisations in a systematic development process to successfully complete the project with the desired capabilities (Schweigert, 2013). But not all of these models have been validated by adequate empirical research, nor are all agile maturity models publicly available. Moreover, these models differ in their underlying structure prescribing different possible paths to maturity in agile software development, all the while neglecting the fact that agile teams struggle to follow prescribed process and practices (Patel & Ramachandran 2009, Fontana, Meyer Jr, Reinehr, & Malucelli, 2015). Hence, organisations might find it more challenging to adopt an appropriate maturity model for their own development process. They might find it difficult to improve their development

process, as not every software project is identical to another. Furthermore, these different agile maturity models employ different agile practices in different order (Sidky, 2007).

The scientific study comparing agile maturity models found that each maturity model includes different levels and different aims related to agile practices that are aligned at different levels. Hence, only a few particular similarities were found among the extracted agile maturity models. But the agile practices embedded in these maturity models were repetitive with one another irrespective to the levels (Deekonda & Sirigudi 2016).

The vast majority of these agile maturity models are to be used by an agile team to assess the maturity of agile adaptation and guide teams towards higher agility adoption. There are few unscientific assessment models that could be applied (e.g. comparative agility, sprint agile), and even fewer are detailed or partially explained for use in assessment. Unfortunately, most models are not scientifically supported and even those that are scientifically based are not available for usage by the public. It is especially regrettable that the model of assessment of received answers is not explained as yet.

For an entity to determine which agile framework is good for their internal usage, Sidky (2007) developed agile adaptation framework by proposing certain agile practices towards agile maturity. As Sidky (2007) stated, his tool is for organisations seeking to adopt agility, and are in need of some tangible structured approach to be taken by organisations to serve for their adaptation of agile practices. This is also a good tool for determining their agile readiness and what are the necessary preparations and difficulties in the agile adoption process. The framework has two main components: Sidky Agile Measurement Index (hereafter: SAMI) and a 4-Stage process that utilises SAMI to determine the agile practices to be adopted and to what extent they should be adopted. SAMI is composed of four components: agile levels, agile principles, agile practices and concepts and indicators as shown in Figure 10 (Sidky 2007).

The 4-Stage process is considered as the "backbone" of the Agile Adoption Framework (Sidky, 2007) since it discovers the showstoppers preventing the adoption process (Stage 1), determines organisations target level of agility with SAMI (Stage 2), assesses the readiness of organisation for targeted agility level (Stage 3), and determines the final set of agile practices to be adopted (Stage 4).

Stage 1: Determines the discontinuing factors of a project in an organisation divided in three groups: inappropriate need for agility, lack of sufficient funds and absence of executive support (Sidky 2007).

Stage 2: Project-Level Assessment to determine the highest level of agility attainable by the project by the level at which the assessment for the limiting factor has failed, are absent and the organisation cannot do anything to change that factor, so the project cannot get to a higher level of agility. This stage assessed the readiness that depended on characteristics outside the organisation control (Sidky 2007).

Stage 3: Organisational Readiness Assessment to know whether it is ready to handle the adoption of certain agile practices before it starts adopting them. Without making proper assessment, an organisation starts to adopt agile practices without knowing whether it is ready for them (Sidky 2007). Stage 3 should fix that problem and relies on agile practices within SAMI, which depend on characteristics that the project or organisation could change.

Stage 4: Reconciliation if there is a higher projects level assessment than the organisation is ready to adopt agile practices up to assessed agility level according to SAMI model (Sidky, 2007).

Figure 10: SAMI concept agile levels populated with agile practices categorised within agile principles
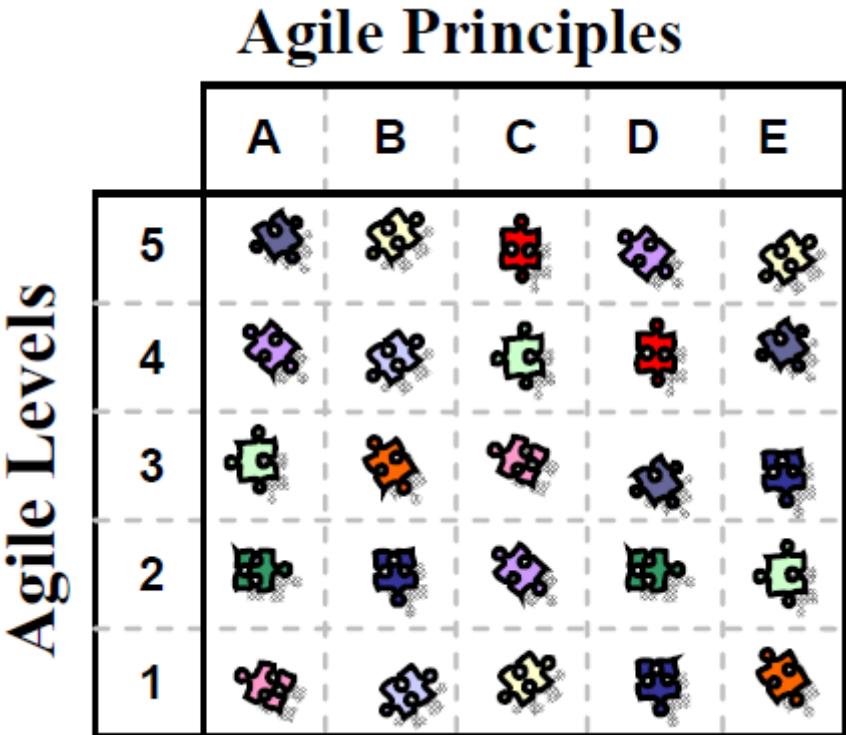
Source: Sidky (2007).

Sidky named the levels in SAMI: level 1 is Collaborative, level 2 is Evolutionary, Level 3 is Effective, level 4 is Adaptive and Level 5 is Encompassing. Out of 12 agile principles Sidky (2007) established 5 essential principles: embrace change to deliver customer value, plan and deliver software frequently, human-centric, technical excellence and customer collaboration. In the matrix between levels and principles there are certain agile practices that need to be adopted in order to reach every level of agility. In every level there are as many practices as needed to cover all 12 agile principles in each level (Sidky, 2007). Sidky made the adoption framework applying only his own knowledge. He did not use the

evaluation tool on some organisations, he just evaluated the items by asking expert agile practitioners to fill in a survey for their feedback on the tool.

The primary drawback according to Soundararajan and Arthur (2014) is that for each level of agility Sidky's assessment model is imposing to organisations to accept a pre-defined set of agile practices, that is seriously contradicting the flexibility proposed by the Agile approach (Soundararajan & Arthur 2014). Sidky's adoption framework is only theoretically proposed model that lists 297 questions to be answered by the stakeholders of the organisation or a project: the customer of the project, the management of the organisation, the developers of that project and the assessor. This framework was just a proposition that was not practically tested on an organisation as assessment of agility level.

In Gren, Torkar and Feldt (2015) study, authors try to validate Sidky's agile adaptation framework. They stated that there are some commercial tools but they are arguing the scientific validation of such models. In their study they shortened the number of questions and used only Level 1 questionnaire from Sidky's framework, to keep the number of items to a minimal, only 29 questions for developers, and conducted a survey on 45 employees from two US-based organisations. They concluded that their statistical analyses suggest this measurement needs more work in order to be a valid measurement of agile practices implemented in a team (Gren, Torkar, & Feldt (2015). Hence, any agile maturity model need more work before considering its reliability. In the survey some items should be altered so that they can be used more widely than just in the IT projects (Gren, Torkar, & Feldt (2015). The authors suggested that researchers should focus more on validating or even merging already proposed maturity assessment tools instead of keep inventing new ones (Gren, Torkar, & Feldt (2015). Gren, Torkar, & Feldt (2015) concluded that since agile principles are more about culture than about a set of implemented methods, the maturity level approach might not be the right one. Or we need to add another focus in the measurements that include cultural assessments instead of degree of used practices. Alternative approaches available on the World Wide Web can also be found, focused on agility assessment based on the adopted agile practices. One of these agility assessment tools is Comparative Agility which presumes that usually software companies only intend to be more agile than their competitors (Williams & Cohn 2010). The authors of the survey-based tool claim that assessment tools developed on the basis of the Comparative Agility approach, allow software companies to assess their Agility degree relative to other organisations that responded to the survey (Williams & Cohn 2010). This tool is available at the website https://www.comparativeagility.com/capabilities/agile-assessment/.

A serious drawback of Comparative Agility is that when comparing companies in term of agility, it is unclear whether or not the adopted agile practices are suitable for a company (Soundararajan, Arthur & Balci 2012). By comparison, Gandomani and Nafchi, (2014) state that different agile approaches focus on different agile values, one part focus on achieving values in project management, and the others focus on software development process.

Software companies in order to maximise possible values should try using combination of them (Gandomani & Nafchi, 2014).

The process of measuring the agility level is somewhat subjective, mainly because of the nature of agility which is not a quantitative value. However, the primary disadvantage of the proposed methods, tools and assessment techniques is their limited scope and application (Soundararajan & Arthur 2011). As most of the tools are intended for assessing agile maturity of organisations that are using agile methodologies and are based on knowledge and usage of agile practices, I did not found any of them appropriate to be used for my survey. However, I did not want to invent new agility assessment model of my own and add to the variety of this class of tools.

One more maturity assessment tool is the questionnaire from Sprint Agile (2021) available at their official web site (https://sprintagile.com.au/maturity-assessment/). Evidently, they based their agile maturity model on the 12 principles of the agile manifesto and they have interpreted some of the manifesto principals in a way that is of great relevance for my research topic. I used the questions of this tool for my survey to assess the level of implementation of agile principles in entities and teams in regard of their intention to use a specific agile methodology, or even just a couple of agile practices for the purpose of running their business, or for implementing projects in service industry in the Republic of North Macedonia. Below, I will expound certain aspects of this model in the empirical part of this thesis.

4.2 The influence of Covid-19 on implementation of agile methodologies

Based on the previous elaboration of agile approaches, the conclusion is that these approaches emphasise direct face-to-face communication and open space working environment, where team members are sitting in close proximity (Dey, 2020), (Schmidtner, Doering, & Timinger, 2021). The benefits of close collaboration includes frequent one-on-one contact with the customer and the stakeholders of the project. Agile practices and events cherish frequent collaborative meetings to avoid failures emerging from misunderstandings (Schmidtner, Doering & Timinger 2021). Yet, all these advantages were challenged when Covid-19 pandemic broke out. All the work habits and practices changed literally overnight, the cases of Covid-19 started to appear everywhere in the country, and on March 11th Macedonian government ordered urgent lockdown for schools and universities. Later on, it was announced that the employees with chronical diseases should stay at home and all non-essential institutions should be closed since people could have group gatherings. The lockdowns supporting social distancing and staying at home were meant to effectively reduce transmission of the coronavirus and saving lives (Flaxman et al., 2020).

In addition to highly competitive industries and economies, organisations around the world have risen to the challenge of the Covid-19 pandemic. Now working environments have to meet the needs of their employees while maintaining business continuity at uncertain times.

At the time of widely-spread pandemic, entities are still trying to cope with the market situation and continue to operate and maintain their position in the markets, penetrate new markets by developing new products or services, searching and making potential investments, etc. All these activities require frequent and fast communication and feedback. On the one hand, the global pandemic has brought into limelight the decline of legacy services, but on the other hand it, accelerated the transition to digital entertainment and to new communication methods. It has also changed the landscape of work and the way we do our jobs. Only a small number of employees had experience in working in a home office environment for an extended period of time (Schmidtner, Doering & Timinger 2021). When Covid-19 pandemic emerged, organisations reduced office hours and asked their employees to work from home. However, despite all technical progress, remote working differs from close collaboration in open space offices (Schmidtner, Doering & Timinger 2021).

People meet, work and cooperate without being in the office until the present day. But some companies still require their employees to come to their premises while struggling to meet safety standards. There are many jobs where full remote work is not possible for every type of work, and even at the peak time of the pandemic close physical meetings cannot be completely avoided. Therefore, they need to find ways to respond to the new challenges. The fast changes in the business environment constantly introduce significant turbulence into the planning and decision-making process in the organisations.

Prior to the Covid-19 pandemic, organisations used to have most of their operation in their offices. However, with the Covid-19 propagation, the possibility of high spread of the disease in North Macedonia became evident as well. Therefore, the immediate change of the old mind-set has become necessary as well as the prerequisite to adapt to new processes, guidelines, and new workplaces.

In the beginning of the pandemic in Germany, Schmidtner, Doering and Timinger (2021) in April, 2020, collected answers from 171 participant in a study regarding the impact of Covid-19 on the collaboration and work practices of employees. They found that before the pandemic only 5% of participants did their work from home, and up to the end of April the percentage went up to 66% of the participants. They found that participants perceived their projects as agile with 49% before the pandemic and agility had a slight increase after the start of the pandemic to 54%. Their final conclusion was that in Germany they had a smooth transition to work from home, work hours became more flexible, and there was a small decrease in productivity. In turn, mobile and video conference tools have shown increased usage, and in the future it is expected for them to have even greater usage than before the pandemic. Their study summarises that many companies and their employees adapted quickly and kept up agile working and productivity (Schmidtner, Doering & Timinger 2021).

Another study by da Camara, Marinho, Sampaio and Cadete (2020) observed the impact of Covid-19 with an agile software start-up in Brazil. Before the pandemic the team worked in the office. With the pandemic, the team faced serious challenges to maintain productivity,

define communication and project management tools, align with clients, protect employees and coordinate the development processes. In the study they took actions to overcome the obstacles and to identify new necessities: to define primary tool for communication, to establish regular daily meetings with the team, to schedule regular meetings with the client and stakeholders, to schedule trainings and workshops and to establish daily team meetings to keep up the team spirit. The authors emphasised that actions taken for picking up the proper communication tool and increasing the collaboration helped the team to reduce software development bugs and improved knowledge sharing among the developers. They noticed that the number of meetings during the pandemic increased drastically (da Camara, Marinho, Sampaio & Cadete 2020).

Handscomb et al. (2020) found that organisations with agile practices were more deeply committed to their everyday work, and managed better the impact of the COVID-19 crisis. These were mature agile organisations that had implemented the most extensive changes to enterprise-wide processes before the pandemic (Handscomb et al. 2020, p. 1). They found that the agile teams have continued their work during the pandemic shock without losses in productivity. On the other hand, transition brought struggle to many non-agile teams facing setbacks in defining work priority and decrease in productivity when remote setup was imposed. The result was that many non-agile teams in order to be able to work effectively in the remote setup started to adopt some of the agile practices during the pandemic (Handscomb et al. 2020).

As the Covid-19 pandemic increased uncertainties, it required adaptive response to changes as the most logical way towards adopting agile practices. For the purpose of my research I have asked a number of project team members working in service industries whether Covid-19 has had a significant impact on their application of agile methodologies.

5 QUANTITATIVE RESEARCH OF IMPLEMENTATION OF AGILE METHODOLOGIES DURING COVID-19 IN NORTH MACEDONIA

5.1 Research questions

The ultimate purpose of this academic research is to become fully aware of the level of agility in project teams and to come to terms with the impact of the Covid-19 pandemic on the implementation of agile methodology in service industry organisations. In a broader sense, this research is intended to provide insights that could help different organisations in the service industry improve the fashion they operate in an uncertain environment caused by the Covid-19 pandemic.

The research objective of this thesis is to do research of the level of implementation of agile principles by project teams in a service industry in some organisations doing business in the Republic of North Macedonia, and to do research on how the project teams in these

organisations in service industry have responded to the implementation of agile practices under uncertainties caused by Covid-19.

The main premise of the thesis is that the Covid-19 pandemic has seriously influenced the implementation of the agile methodology. The research questions that are in accordance with this premise are as follows:

- Q1: What is the level of implementation of agility or agile principles in the service industry?

- Q2: What impact has Covid-19 had on the implementation of agile practices?

5.2 Research design and methodology

5.2.1 Questionnaire design and methodology

Based on the theoretical part of the thesis, which mainly relies on relevant literature produced by foreign authors as well as on internationally-acknowledged scholarly articles related to project management and agile methodology as well as on further research of the scientific literature so as to acquire greater knowledge of agile methodologies, assessment of agile adaptation in teams and organisations for the needs of my research on influence of Covid-19 pandemic on organisations' adaptation of agile methodologies, I made a questionnaire of my own and conducted a survey in order to find satisfying answers to my research questions.

In my research, I do not focus the questionnaire on organisations that have teams which declare themselves to be agile practitioners who have put into practice an agile methodology, but I target the teams that may not be familiar with the agile practices. Therefore, rather than using the scientific agile maturity models focusing on adaptation of specific agile practices, I have chosen to ask more people-friendly questions based on the 12 Agile Manifesto Principles. Thereby, I was able to assess organisation's project teams on the level of adoption and adaptation of agile principles in their project management, even if they do not clearly indicate that they use agile approaches and practices.

I collected data using a questionnaire that contained both open-ended and closed-ended questions. The questionnaire was shared with a number of employees in the organisations in the service industry working in the Republic of North Macedonia.

In the introduction of the questionnaire I provided some initial information about the survey. In the first part, I presented my personal information and information on the reason why I am conducting this targeted survey. In the second part, I kindly asked the participants to answer the questions from the perspective of the team they are on, and how they generally work on a project. In the last part, I explained that the survey is anonymous, so all information provided will be handled confidentially. In the master thesis, I will not reveal any personal information about the participants nor about the organisations, i.e. their names

or company titles. The data collected will only be used for scientific purposes and to answer the research questions of this survey.

The questionnaire consists of four parts. The first part consists of four questions, whose purpose is to collect information about the specific organisation and participants' occupation. Specifically, the first two questions are related to the industry and the size of the company in terms of the number of employees i.e. the personnel. The next two questions are about the participant, asking them how long they have been working with the current team members, and what is their professional calling.

In the second part of the questionnaire, I asked a series of questions to find out whether their teams are managing projects in the agile manner, even if they did not indicate that they are using the agile methodology. The second part of my questionnaire is based on the 12 questions from "sprintagile.com.au", which are based on the 12 agile principles. The questions are expected to be used by software professionals and teams that have previously stated practising of agile practices. In order to make the questions more appropriate for my research and for the questions to have a more acceptable and understandable vocabulary for the teams in the service industries, I have changed some of the expressions and slightly adjusted the text of some questions too. My intention was to keep the questions as unchanged as possible so that I do not jeopardise the maturity assessment tool. I have also changed some expressions, namely the words "software" to "solutions" and "code" to "product". For instance, the question number 7 asking "How often do you deliver working software to production?" was changed to "How often do you deliver working solution to production?" The next change is seen in the question number 13, and the answers are adopted from software development vocabulary to become more suitable for non-software teams. The proposed answer was: "All our developers have read "Clean Code" by Uncle Bob (or similar books) and consider themselves "Software Craftsman", which I changed into "We put all our effort to ensure that well-considered and sufficient technical thoroughness and rigor are applied to projects under an uncompromising commitment to safety and mission success."

Even though the questionnaire is primarily intended for self-assessment of adaptation of agile principles for a project team that is practising the APM, in my case I will use it to assess the level of agile implementation in teams that not necessarily implemented any agile framework. I will use it to determine the level of adaptation of agile principles in a project management team in an organisation in the service industry, and not in a software development company, nor will I expect that it is used for software development only. I tried to avoid teams that are primarily developing software, even in the project teams working in service industries.

In terms of Sprint Agile (2021), the agile capability inventory is an agile maturity assessment tool. They propose that the tool can be used as a model to help agile teams learn and improve in a structured way. Their Agile maturity model is based on the 12 principles of the agile manifesto and they have interpreted some of the manifesto principals in a way that is more

relevant to today's project management issues. They claim that it is a structured approach for setting achievable targets and measuring progress, and each question also provides an education opportunity.

The process of assessment is presumed to be in the form of an interview with the team, yet I opted to share the questions with my associates and acquaintances, and asked for additional project teammate of theirs to answer the questionnaire too. Unfortunately, I have got just one third of the second teammate answers so far.

Each question has answer points 1, 2, 3, 5, 8 as per the Fibonacci sequence. Point 8 is the most mature option depicting highest competence. Adversely, point 1 is the least maturity level depicting lowest level of competence. The prescribed process is to get the team to agree on most appropriate answer for the question, but in my case I did not gather the team in one place, but instead I asked the team members to answer the questionnaire on their own.

By analysing the answers from the two project teammates, I evaluated the team maturity whereas for teammates that scored a different point for the same question I will estimate the arithmetic mean of the points scored for that particular question.

Using the points scored on the questions, I will create a radar diagram based on the results for each question. Through this diagram I am going to give an assessment of the level of implementation of agile principles by a team in an organisation in the service industry operating in North Macedonia. Sprint Agile (2021) affirms that there are three levels of a team agile maturity adoption: a high competency team, a medium competency team, and a low competency team. The benchmark of low competency (also called a threshold competency) was associated with a team that had mostly scored 1 or 2 points, and some answers scored 3 points at the most. Expectantly, the benchmark of medium competency was given to a team that had mostly scored 2, 3 and 5 points. Ultimately, the benchmark of high or highest competency was given to a team on which a few members had scored 3 points only, but most of the team members had scored higher-than-three points. Although this approach is supposed to be an excellent tool for project teams to improve their agile maturity adoption, I will neither give feedback to assessed team, nor do I intend to repeat the assessment in the next few months so as to re-evaluate the team improvement on agile adoption.

In the third part of the questionnaire, I posed another series of leading questions intended to measure the participants' usage of agile project management practices. The questions in this section are part of the questions of Digital.ai (2020) in the 14th Annual State of Agile Report. The first question in this section, refers to the participants' team usage of agile project management practices. If answered yes, I added additional seven leading questions to be done, inquiring which agile methodology they currently used, how long and how often they had been using it, whether it was for software only projects, reasons for adopting agile practices i.e. reasons for adopting agile practices by the participants, and finally what

benefits were gained by adopting agile. If answered no, I added one additional leading question, inquiring why they had not used agile project management methodologies, including six predefined statements to be rated by Likert scale from 1 to 6, completely disagree to completely agree, and possibility for other answer as open-end possibility.

In the last section of the questionnaire, there was a new series of leading questions about the influence of Covid-19 on the agility acceptance. Specifically, there were five closed questions and three open-end questions. In the close-end questions, I asked the participants whether it was possible to do their work remotely, whether their work took place at the same location, whether they were aware of other team in their organisation that did not do the work at the same location, whether they had adopted agile practices before the outbreak of Covid-19 pandemic, and whether Covid-19 affected adoption of agile practices. The last three questions are open-end questions questioning about challenges faced during Covid-19, actions taken to overcome challenges, and whether Covid-19 affected adoption of agile practices, and if so in what manner.

5.2.2 Data gathering

The survey was sent to employees in the service industry organisations in the Republic of North Macedonia. Through the questionnaire, I made an attempt to collect information on how teams manage projects in an agile manner, no matter whether they stated that they did make use of agile approaches to manage their projects or not, and a couple of questions about the influence of the Covid-19 pandemic on their intention to use agile approaches and practices, and how the pandemic has influenced their way of operating.

Quantitative data were gathered through the questionnaire as a word document, sent by email, via LinkedIn or by Viber. The respondents were asked to highlight the chosen answer for the question and to answer the last three open-end questions. I did not find any better way for sending the report to more potential participants because I could not find any other appropriate way to interlink, so to speak, the participants to their team and/or organisation. I simply did not want to collect participants' particulars and organisation info in the survey since it would require additional permissions.

As for the responders who took the questionnaire, I was not sent back any complaints about understanding the predefined statements in the questions. Yet, I received some complaints that the time needed for answering the questionnaire questions was longer than the estimated15 minutes.

The questionnaire was sent via the mentioned communication means in English only, without any translation into Macedonian taking place as I presumed that some of the leading questions may well lose their core meaning, and thus I may get responses that could be influenced by the quality of the translation.

The survey was conducted in the period from 01.09.2021 to 30.09.2021. Upon participating in the survey, a few respondents stated that the questions of my questionnaire aroused additional close interest in agile practices, and they were also happy to have had the chance to learn something new to try to implement in the future.

5.3 Results

5.3.1 Analysis of data gathered

I invited 47 people to do the questionnaire, and I received response from 35 participants from 25 teams within 19 organisations, which are part of the service industry, conducting their operations in North Macedonia.

Organisations are marked as OrgN, where N stands for the number representing a different organisation in the final results. Hence, the first organisation has the acronym Org1, the second has Org2, etc. respectively up to Org19. The teams were marked as T1, T2, etc. up to T25. The participants are marked as P1, P2, etc. up to P35.

5.3.1.1 The first part of the questionnaire – demographic

Most of the participants in my survey that is 83% were from the telecommunication industry and service implementation and support industry, as shown in Table 1.

I managed to have participants from service industry organisations with different head count, as shown in Table 2. Nonetheless, there are a lot more organisations in the service industry in North Macedonia. Although this is a good representative sample of diverse organisations in terms of their size and capacity, I cannot consider my questionnaire as a representative sample for the entire service industry in North Macedonia.

The respondents were asked for how long they have been working with most of their current teammates as a good practice for any team is not to move people between teams. I received an answer that as many as 86% of the respondents have been working along with most of their current teammates for over a year, as shown in Figure 11.

The five participants, who have been on the team for less than a year, belong to five different teams out of five different organisations whereas four of them were the only participants representing their team. Out of nine teams with more than one participant in the survey, seven teams have teammates with different experience. More details of responses per organisation and per team are presented in Appendix 2 in Table 3.

Table 1: Responses of participants in what industry they are

Organisation	Team	Consulting	Finance services	IT Industry	Service implementation and support	Telecommuni-cations services provider
Org1	T1		1			
Org2	T13					3
	T15					2
	T19					1
	T2					2
	T20					1
	T3					1
	T9					2
Org3	T4				2	
Org4	T5			1		
Org5	T6				1	
Org6	T7					1
Org7	T8				1	
Org8	T10				2	
Org9	T11					2
Org10	T12				1	
Org11	T14				2	
Org12	T16		1			
Org13	T17	1				
Org14	T18				2	
Org15	T21				1	
Org16	T22				1	
Org17	T23			1		
Org18	T24				1	
Org19	T25	1				
Grand Total		2	2	2	14	15

Source: Own work.

Taking into account the responses of the fourth question, which refers to their occupation, most of the participants that is 80% of them belong to the technical domain, as shown in Figure 12. As I obtained most of the responses from the so-called technical industries, this result was expected. Only 7 out of 35 respondents do not work in the technical department. These 7 participants were part of only 4 teams. In all other teams, I received quick responses only from teammates working in the technical department of their organisations. More details of responses per organisation and per team are presented in Appendix 2 in Table 4.

Table 2: Size of participants' organisations

Organisation	Up to 30	31 – 100	101 – 500	501 – 1000	1000+
Org1				1	
Org2					12
Org3	2				
Org4	1				
Org5	1				
Org6	1				
Org7			1		
Org8			2		
Org9					2
Org10				1	
Org11			2		
Org12			1		
Org13		1			
Org14		2			
Org15	1				
Org16			1		
Org17				1	
Org18	1				
Org19	1				
Grand Total	8	3	7	3	14

Source: Own work.

Figure 11: Respondents working experience in their current team
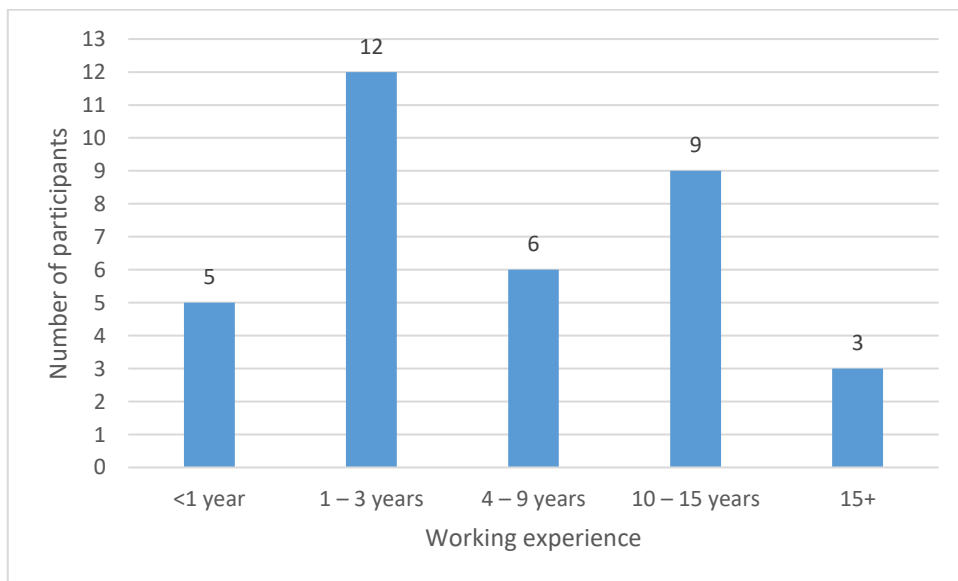
Source: Own work.

Figure 12: Respondents occupation
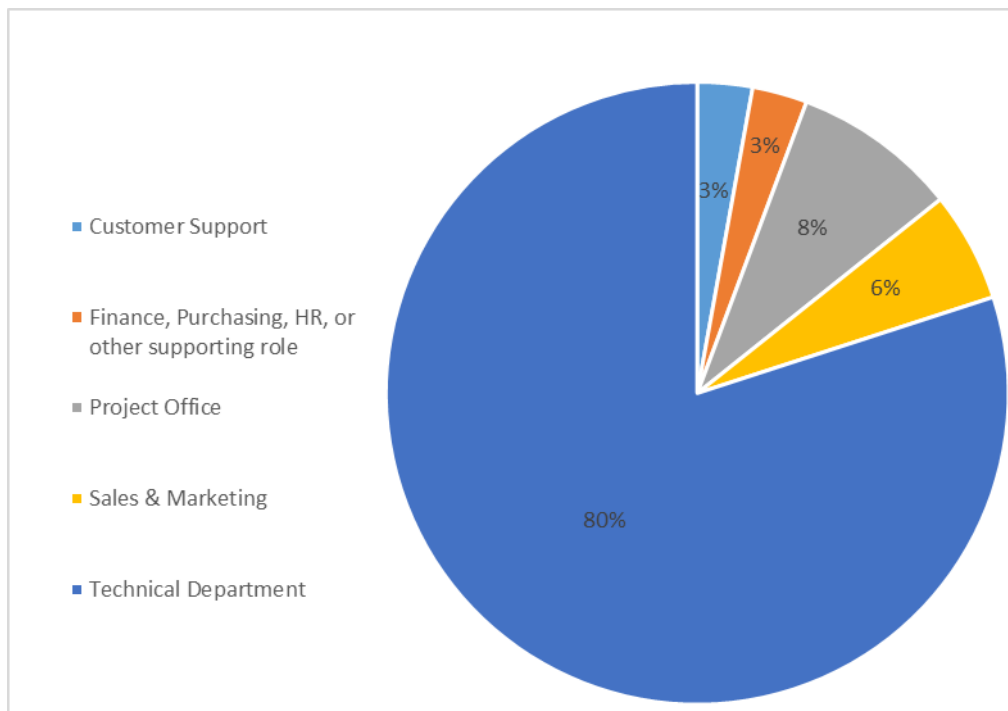
Source: Own work.

5.3.1.2 The second part of questionnaire – assessment of the agile maturity adoption by three benchmarks

In the next part, I will present the responses per team, on the 12 questions regarding the level of agile maturity adoption. The table with responses are presented in the Appendix 2 of this master thesis as the layout of the data tables is very long, and as such, it burdens the presentation of the results of the findings. Only a radial diagram per team will be presented in the following part. Since there was more than one participant per team, the radial diagram is made on the basis of the average response per team.

The details of the responses per respondent as well as the calculation of the average mean of teammate's responses will be shown in Appendix 2 tables.

As seen in the Appendix 2, Table 5, I received only 1 response from Team1. Given the data and Sprint Agile's (2021) assessment guidelines for agile maturity adoption, I found that the Team1 agile maturity adoption provided a benchmark for high competency, as shown in Figure 13 and Appendix 2, Table 5.
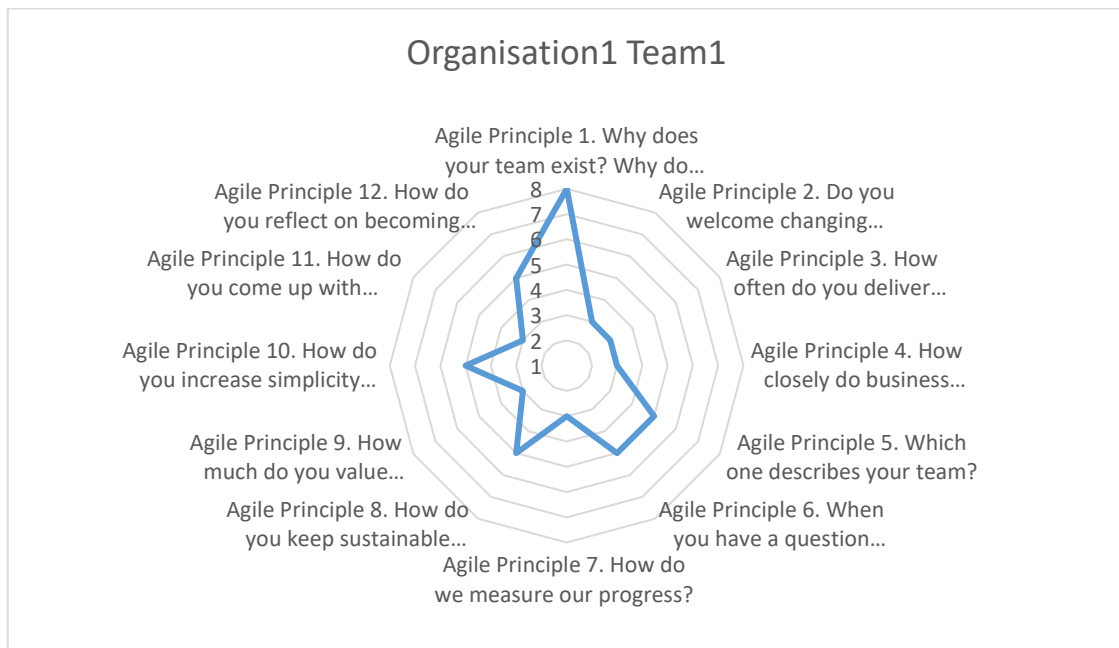
Team2 participated with two of their members. Based on their responses, I calculated the average points in order to correctly assess the agile maturity adoption. With regard of the calculated average points scored by this team, I deem that the Team2 provided a benchmark for medium competency, as shown in Figure 14 and Appendix 2, Table 6.

Figure 14: Radial diagram for Team2
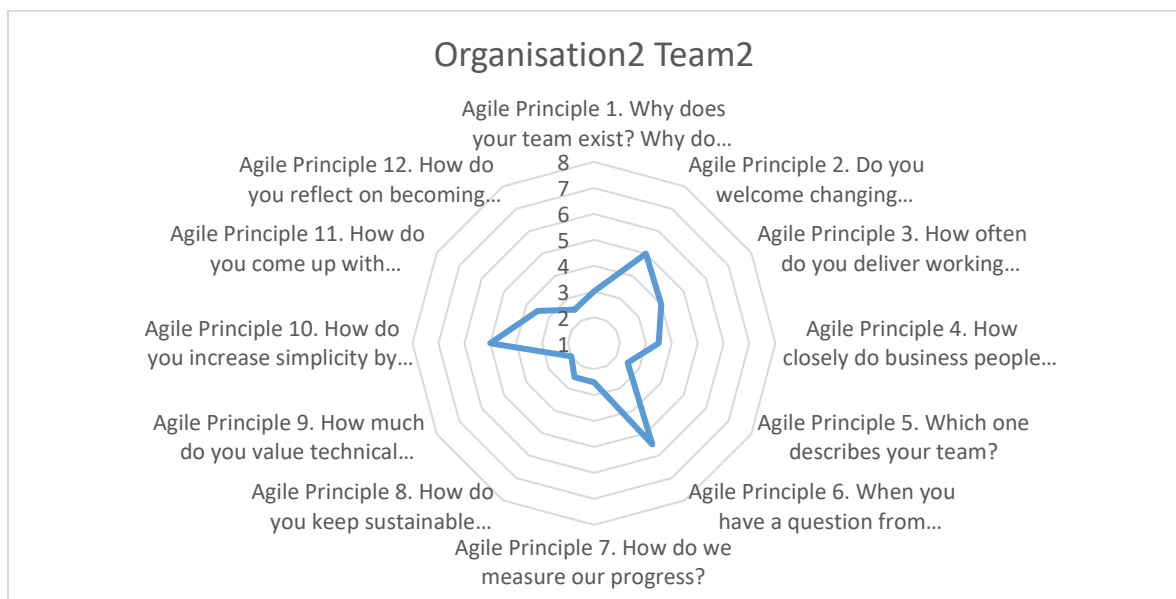
Team3 participated with one participant only. The agile maturity adoption was characterised with different scores per each question, most of them showing high competency, but also there were three questions that ended up with very bad answers, yet they showed a great potential for improvement. Given this results, I would say that the Team3 agile maturity adoption provided a benchmark for high competency, as shown in Figure 15 and Appendix 2, Table 7.

Figure 15: Radial diagram for Team3
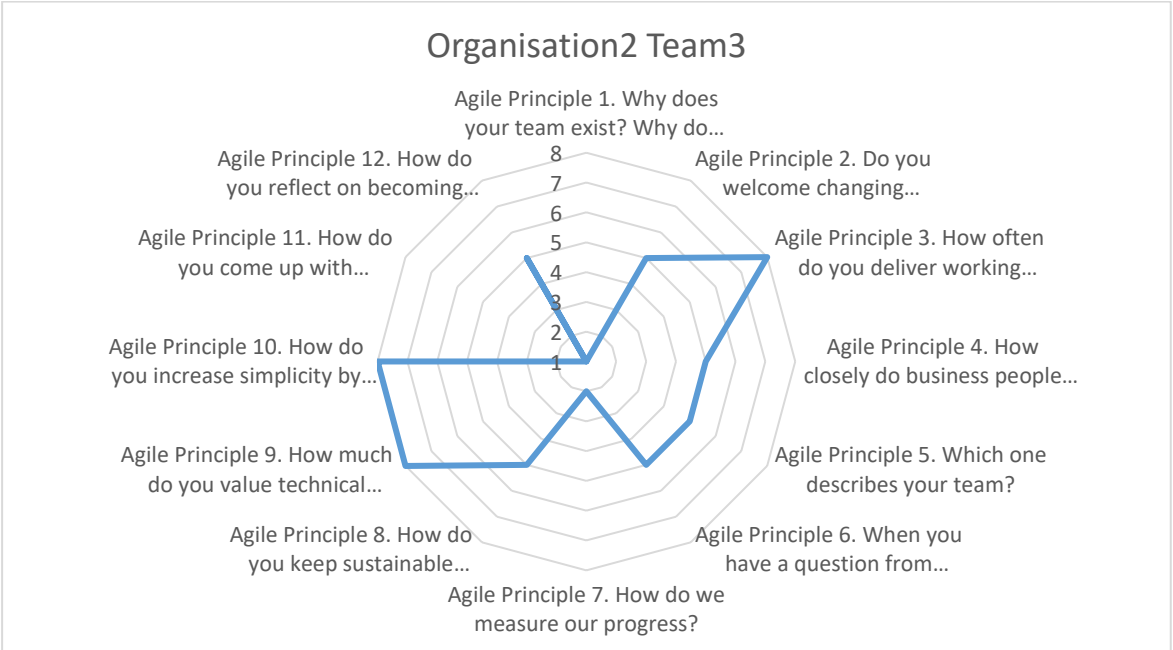
Source: Own work.

Team4 consisted of two participants in the survey. Based on their responses, I promptly calculated the average points, which put the Team4 in the class of high-competency teams, as shown in Figure 16 and Appendix 2, Table 8.

In accordance with Sprint Agile guidelines (2021), the Team5 agile maturity adoption provided a benchmark for high competency, as shown in Figure 17 and Appendix 2, Table 9.

Figure 16: Radial diagram for Team4

Organisation3 Team4
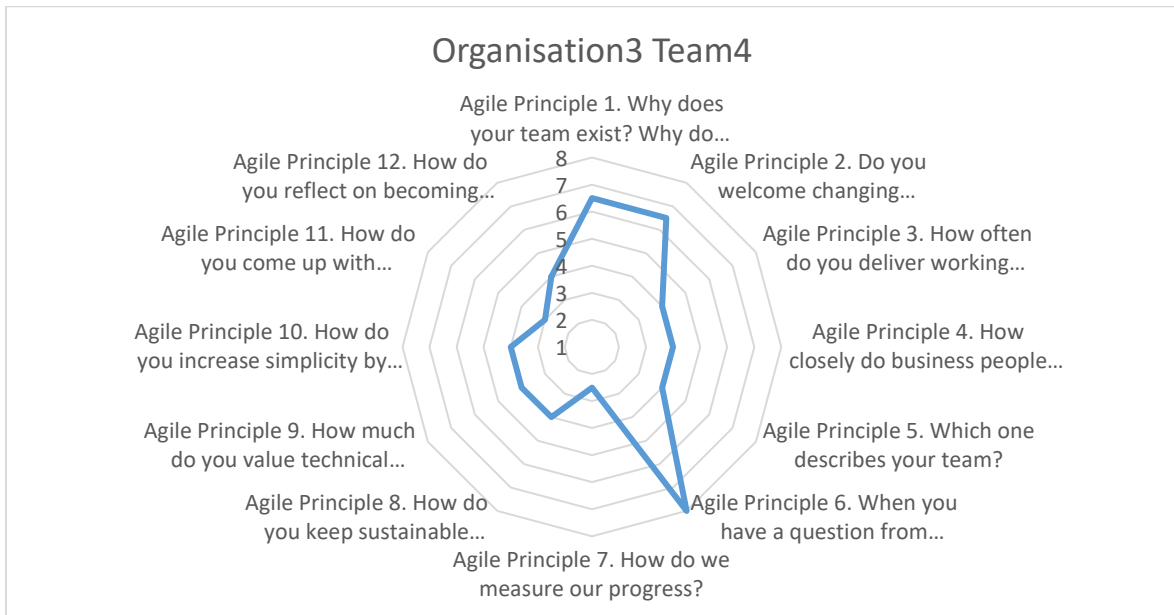
Source: Own work.

Figure 17: Radial diagram for Team5

Organisation4 Team5
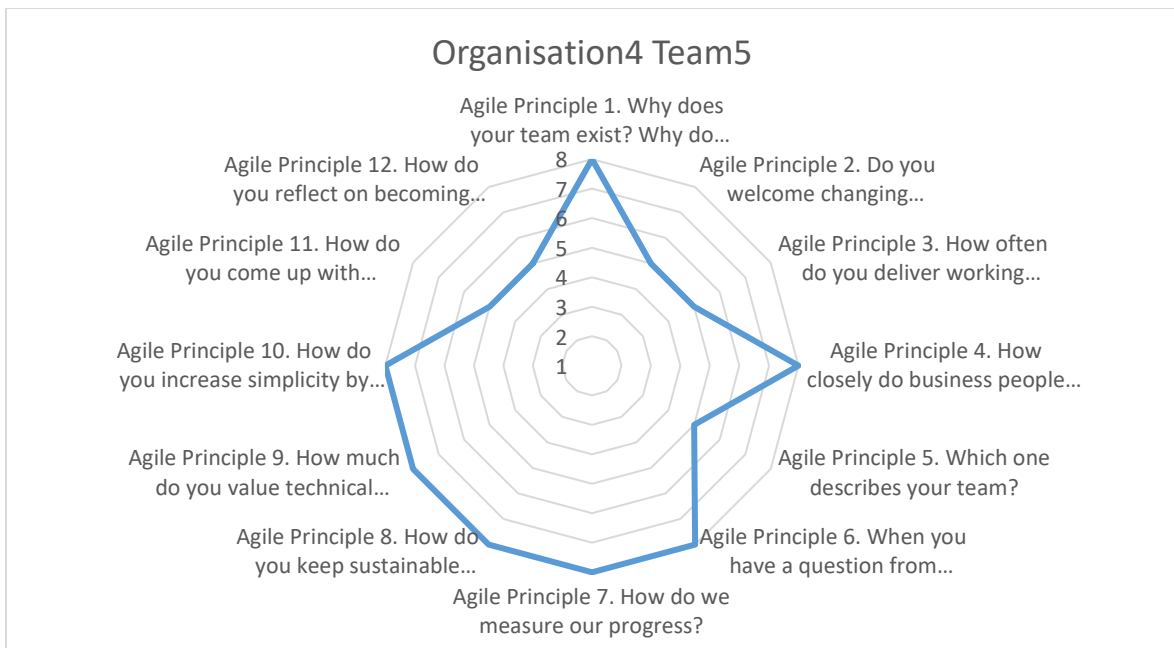
Source: Own work.

Although there were several questions that scored high 5 points, the last 5 questions were not done, therefore I gave these unanswered questions 1 point only. The Team6 agile maturity adoption provided a benchmark for low competency i.e. threshold competency, as shown in Figure 18 and Appendix 2, Table 10.

Figure 18: Radial diagram for Team6

Organisation5 Team6

Source: Own work.

Team7 supplied only one answer that scored 2 points, but I personally consider their agile maturity adoption to provide a benchmark for high competency, as shown in Figure 19 and Appendix 2, Table 11.

Figure 19: Radial diagram for Team7

Organisation6 Team7
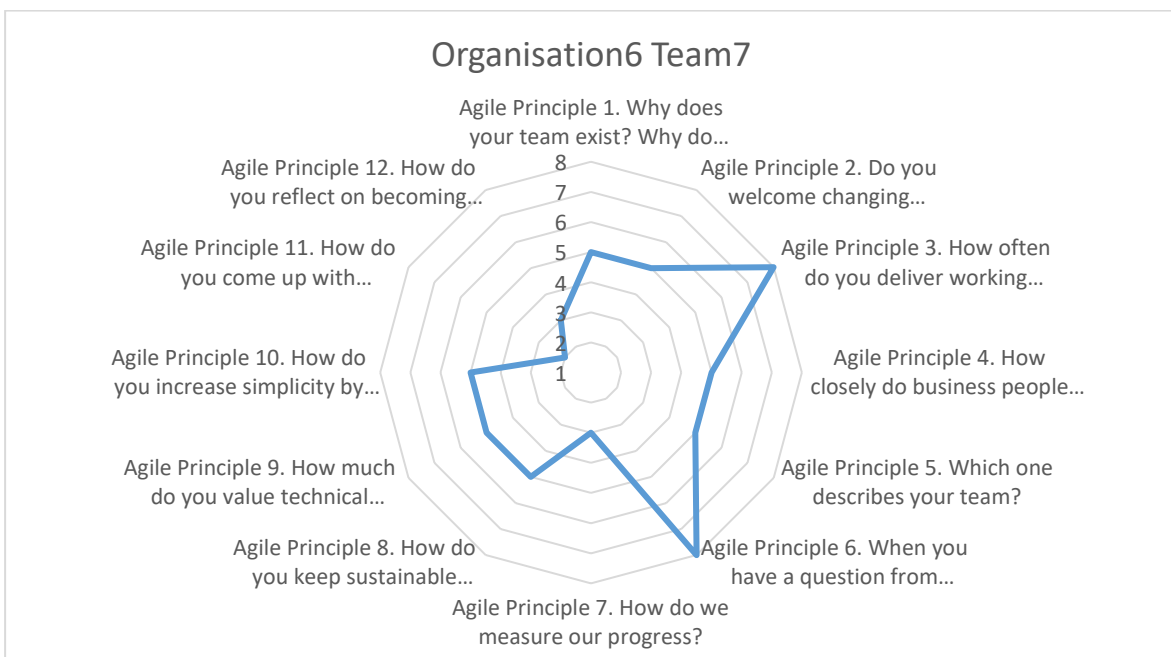
Source: Own work.

Team8 agile maturity adoption provided a benchmark for medium competency, as shown in Figure 20 and Appendix 2, Table 12.

Figure 20: Radial diagram for Team8
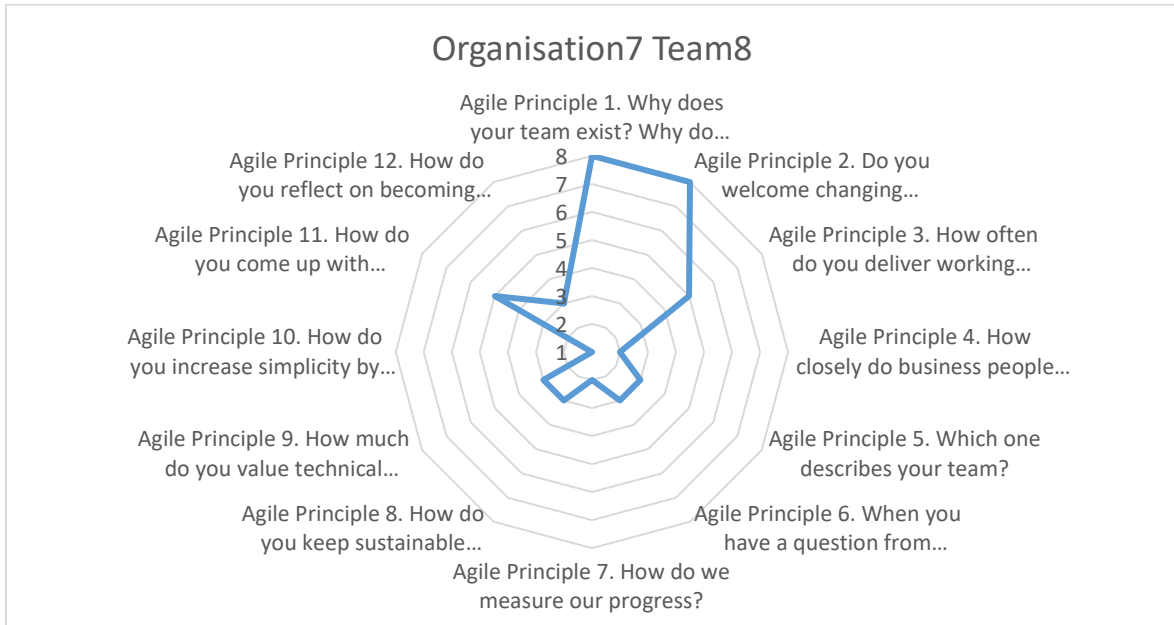
Source: Own work.

Team9 participated with two of their members. The average points showed that the agile maturity adoption could provide for medium competency only, as shown in Figure 20 and Appendix 2, Table 13.

Figure 21: Radial diagram for Team9
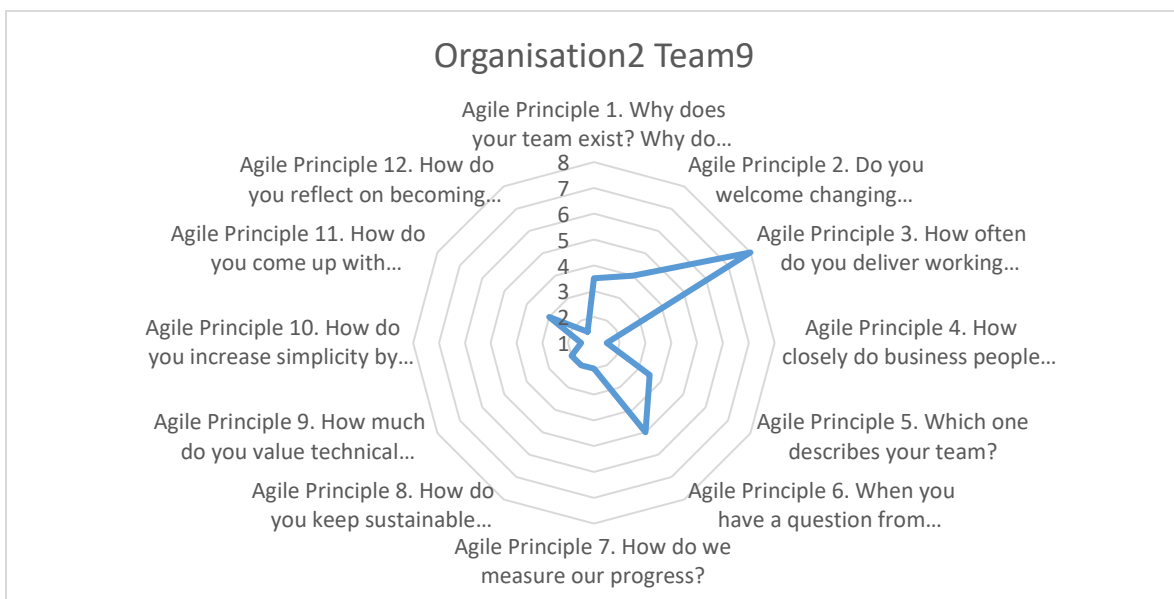
Source: Own work.

Team10 participated with two of their members as well. The average points revealed that the agile maturity adoption could provide for the high competency level, as shown in Figure 22 and Appendix 2, Table 14.

Figure 22: Radial diagram for Team10
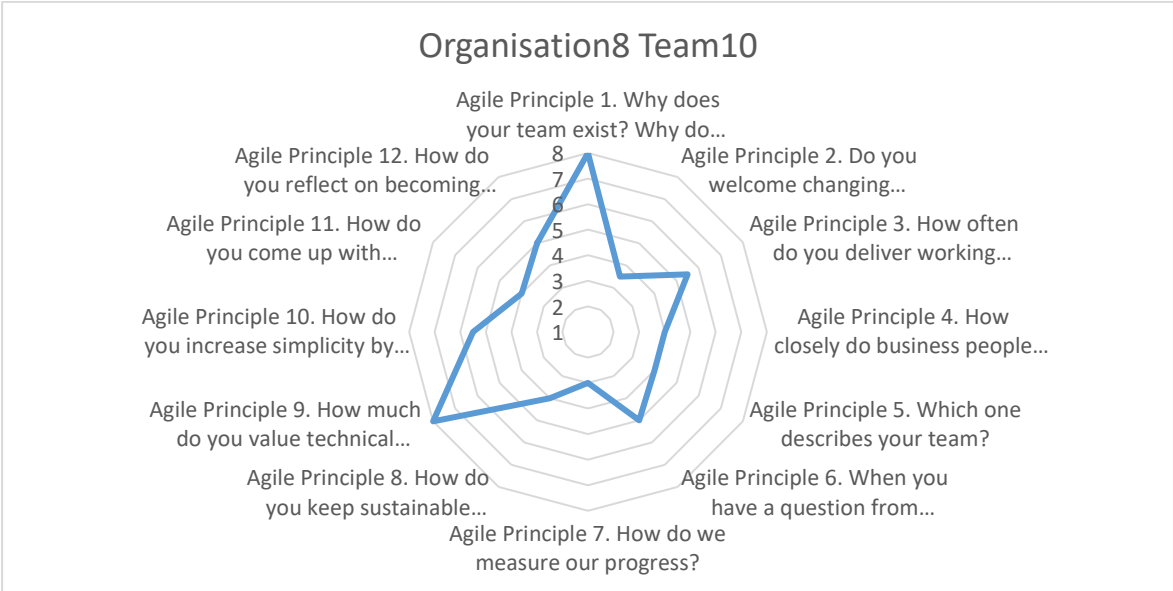
Source: Own work.

Team11 participated with two of their members as well. The average points scored on most of their answers were 3 and 5 point. Accordingly, the assessment of agile maturity adoption, puts Team11 in the class of medium competency teams, as shown in Figure 23 and Appendix 2, Table 15.

Figure 23: Radial diagram for Team11
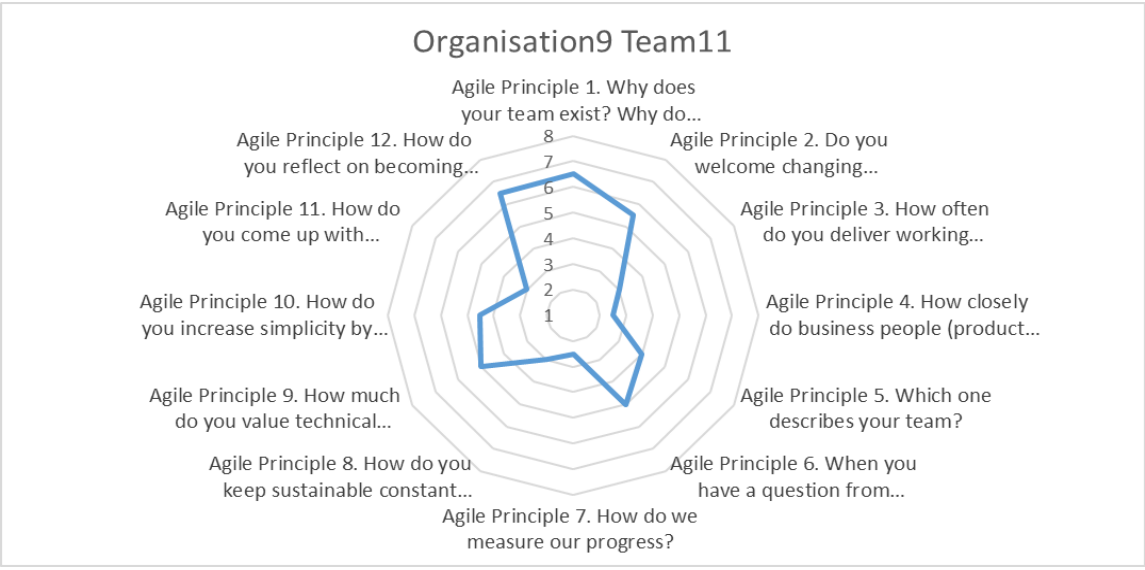
Source: Own work.

Team12 supplied most of the answers that scored 5 and 8 points. Accordingly, the assessment of agile maturity adoption, defines the Team12 as a high competency one, as shown in Figure 24 and Appendix 2, Table 16.

Figure 24: Radial diagram for Team12
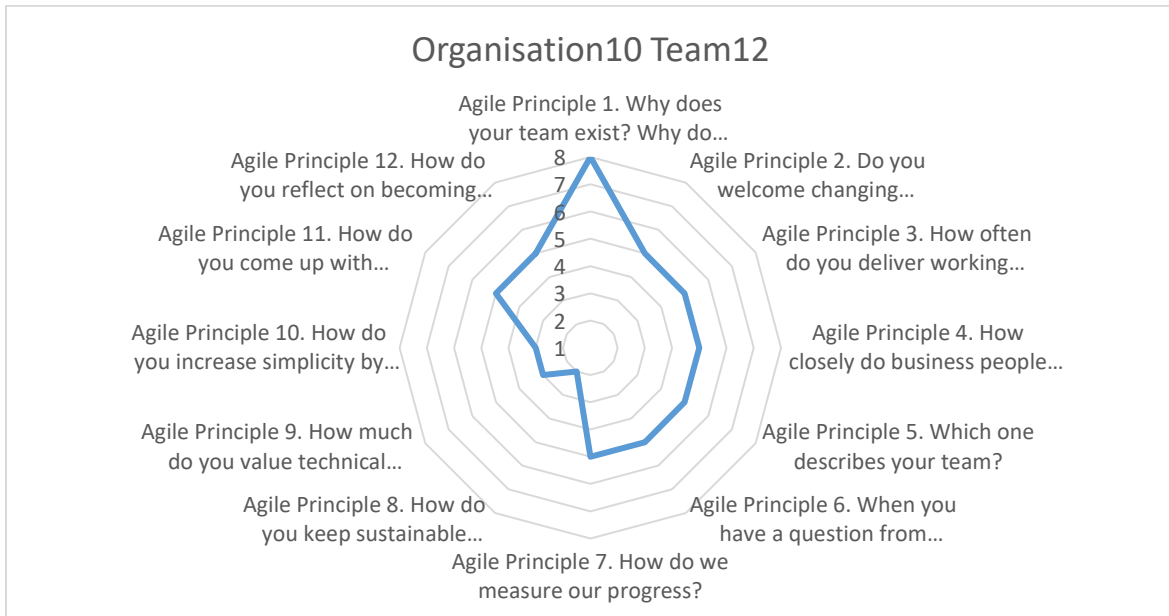
Source: Own work.

Figure 25: Radial diagram for Team13
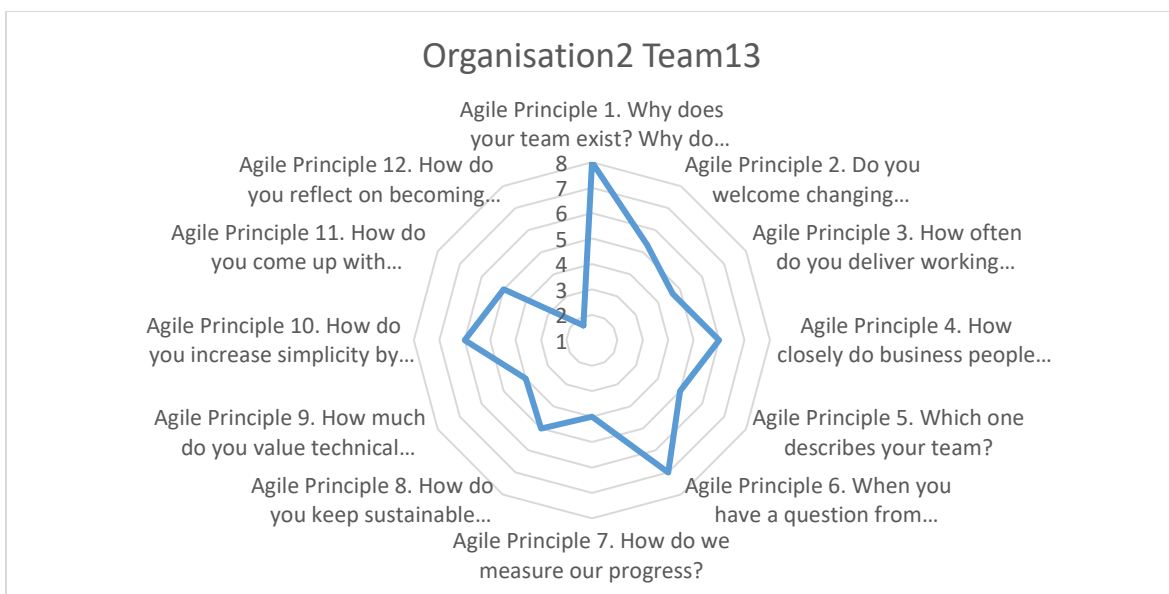
Source: Own work.

Team13 was the only team with three participants. Their average points scored per answer were around 5 and 8 points. Accordingly, the assessment of agile maturity adoption defined the Team13 as a high competency team, as shown in Figure 25 and Appendix 2, Table 17.

Team14 participated with two of their members only. Their average points per answer were around 5 and 8 points. Accordingly, the assessment of agile maturity adoption, puts the Team14 in the class of high competency teams too, as shown in Figure 26 and Appendix 2, Table 18.

Figure 26: Radial diagram for Team14
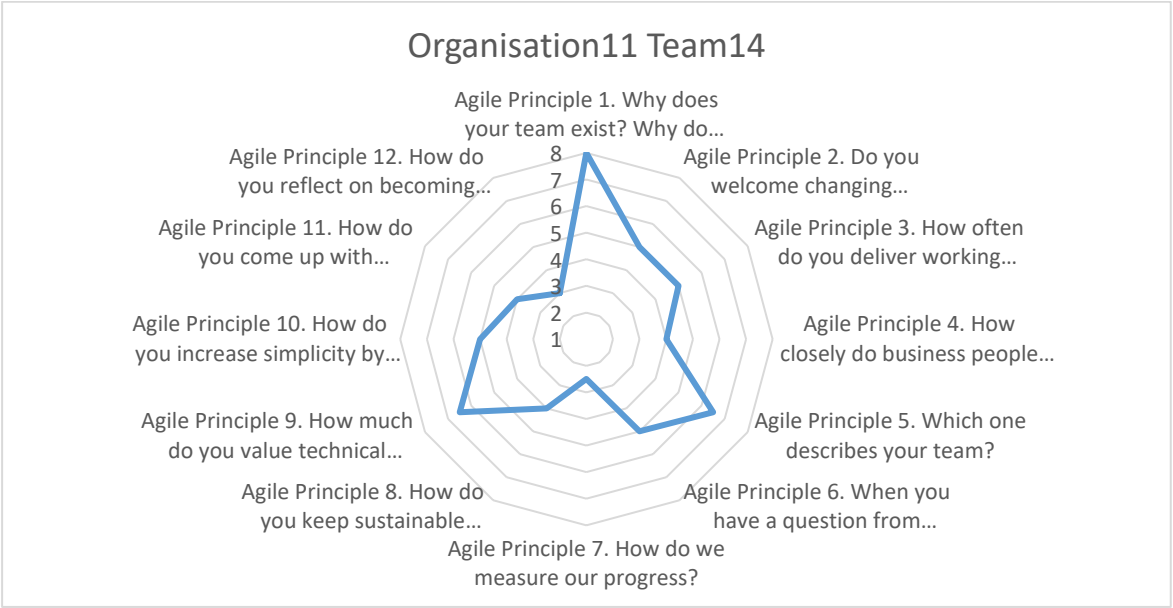
Source: Own work.

Team15 also had two participants. Their average points scored per answer were around 3 and 5 points. Accordingly, the Team15 agile maturity adoption provided a benchmark for high competency as well, as shown in Figure 27 and Appendix 2, Table 19.

*Figure 27: Radial diagram for Team15*

Organisation2 Team15
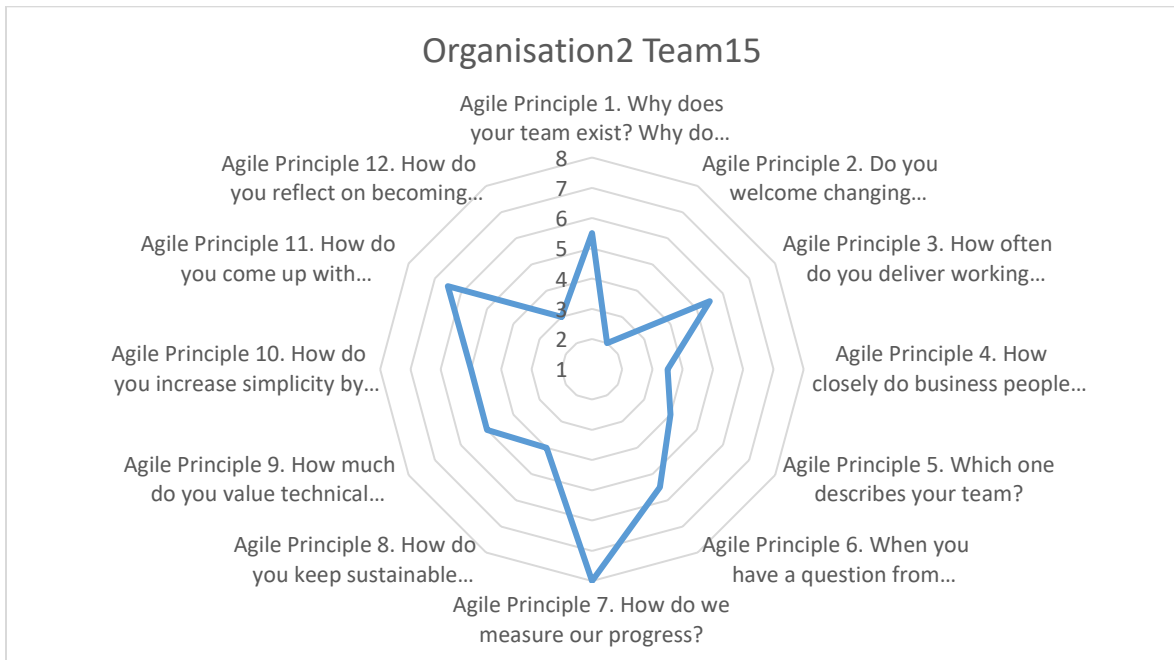
Source: Own work.

Team16 participant gave answers that scored mostly 5 and 8 points. Given this result, Team16 agile maturity adoption provided another benchmark for high competency, as shown in Figure 28 and Appendix 2, Table 20.

Figure 28: Radial diagram for Team16

Organisation12 Team16
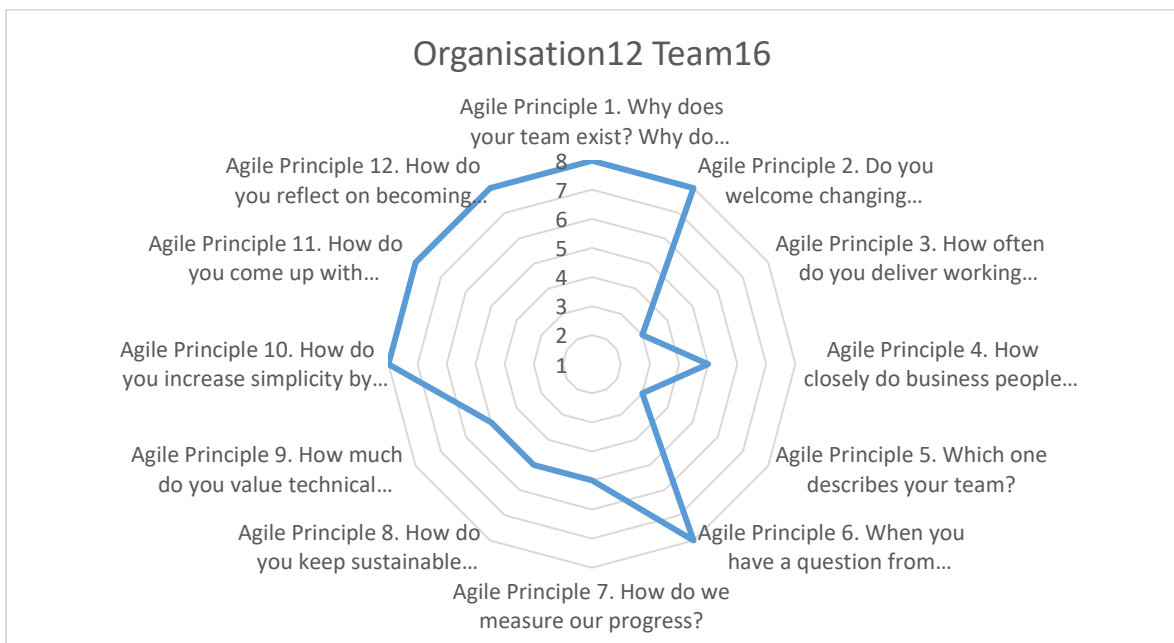
Source: Own work.

Team17 had one participant too, whose answers scored mostly 3 and 5 points, which provided another benchmark for medium competency, as shown in Figure 29 and Appendix 2, Table 21.

Figure 29: Radial diagram for Team17
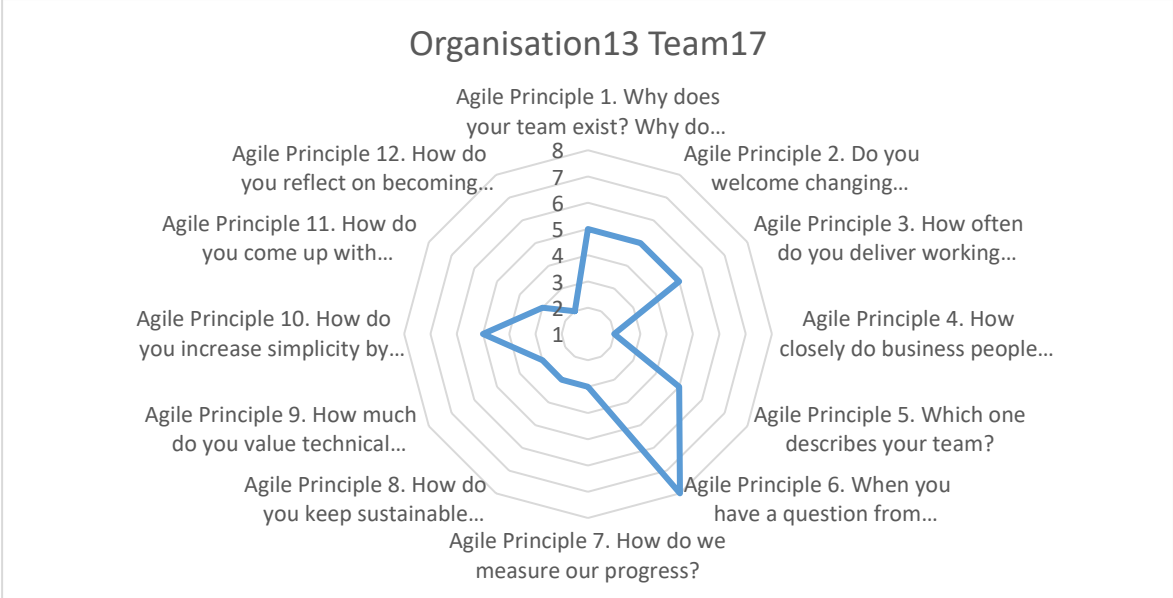
Team 18 had two participants who responded quite differently. Actually, participant P25 did not answer half of the questions, thus I evaluated them with 1 point only. With this adjustment, the average scored points were mostly around 5. Given this results, the Team18 also provided a benchmark for high competency, as shown in Figure 30 and Appendix 2, Table 22.

Participant P21 on Team19 gave answers which also scored uneven points, but most of the answers scored 5 or 8 points. Accordingly, the Team19 provided a benchmark for high competency, as shown in Figure 31 and Appendix 2, Table 23.

Figure 30: Radial diagram for Team18

Organisation14 Team18
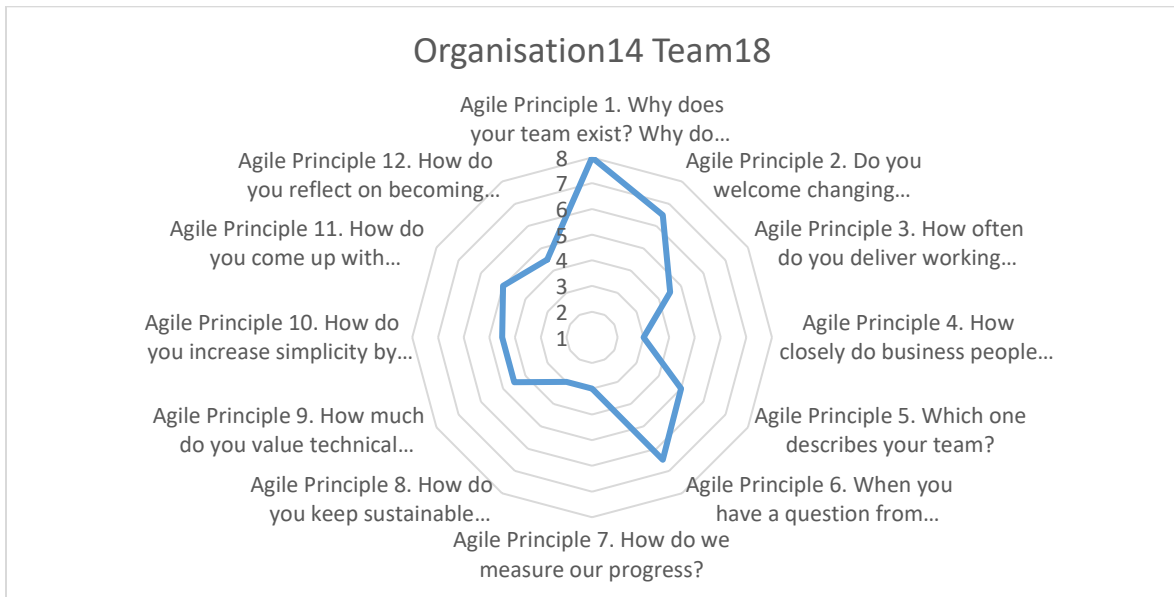
Source: Own work.

Figure 31: Radial diagram for Team19

Organisation2 Team19
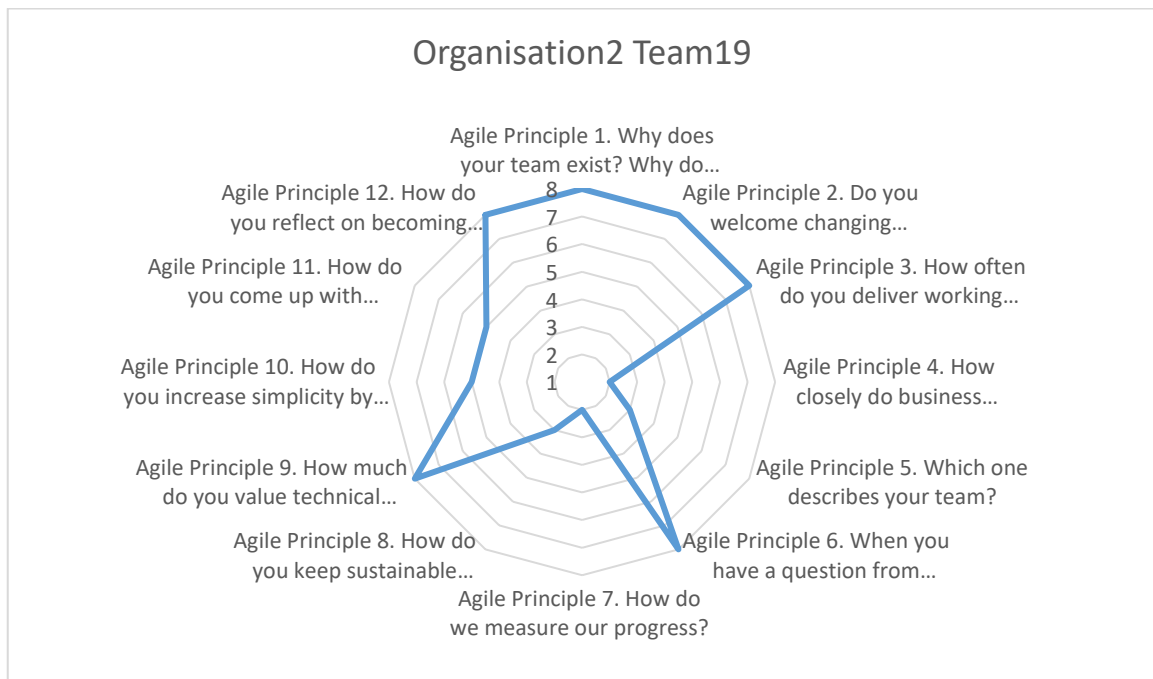
Source: Own work.

The participant P22 on Team20 gave most of the answers that scored 3 or 5 points. In compliance with the assessment of agile maturity adoption, the Team20 provided a benchmark for medium competency, as shown in Figure 32 and Appendix 2, Table 24.

Figure 32: Radial diagram for Team20
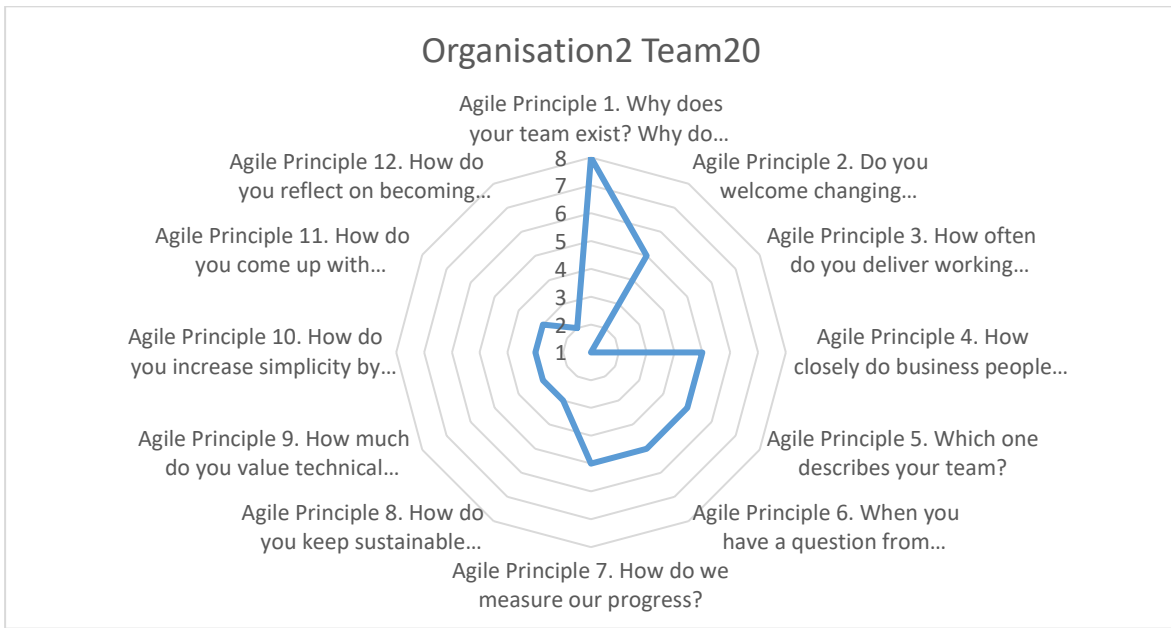
Source: Own work.

Team21 also supplied a series of handy answers, which showed a hidden potential for improvement. Hence, the Team21 provided a benchmark for high competency, as shown in Figure 33 and Appendix 2, Table 25.

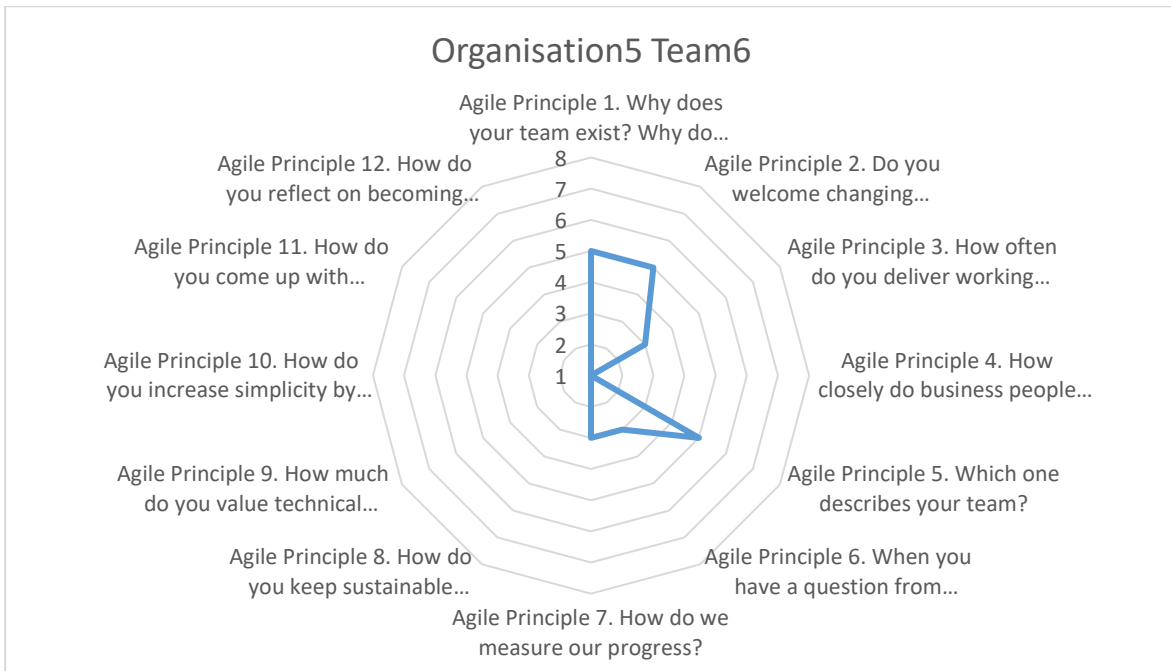*Figure 33: Radial diagram for Team21*
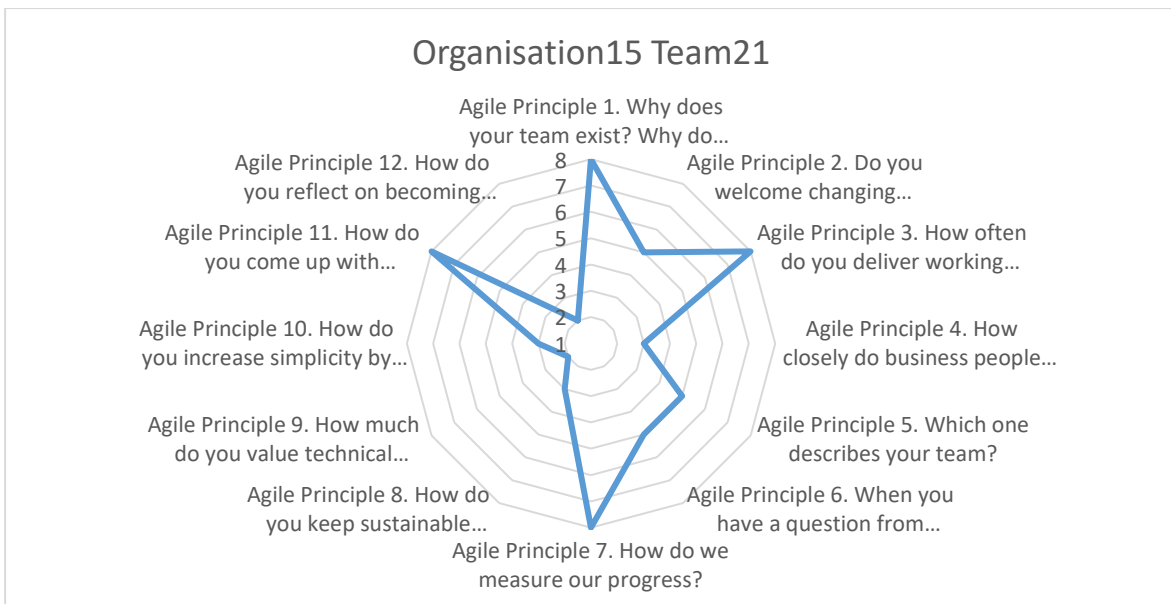
Source: Own work.

Team22, similarly to the previous team, gave a series of mixed answers, which showed a hidden potential for improvement as well. Hence, the Team21 provided the same benchmark for high competency, as shown in Figure 34 and Appendix 2, Table 26.

Figure 34: Radial diagram for Team22
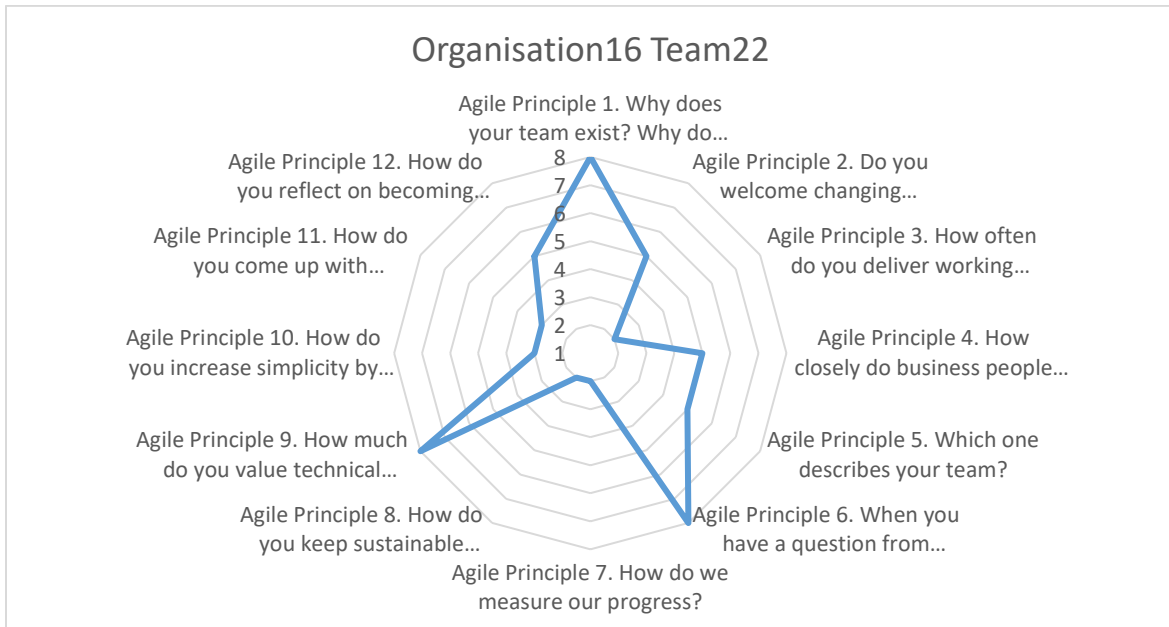
Source: Own work.

Figure 35: Radial diagram for Team23
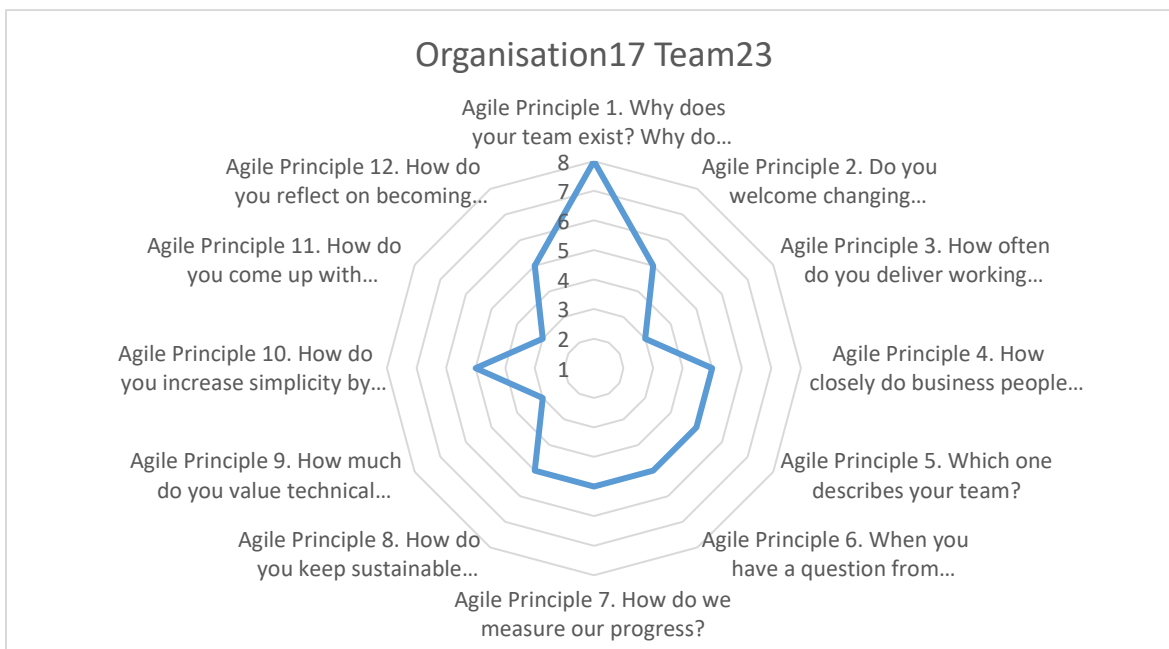
Source: Own work.

The assessment of agile maturity adoption, included the Team23 in the class of high competency teams, as shown in Figure 35 and Appendix 2, Table 27.

The assessment of agile maturity adoption, had also included the Team24 in the class of high competency teams, as shown in Figure 36 and Appendix 2, Table 28.

Figure 36: Radial diagram for Team24
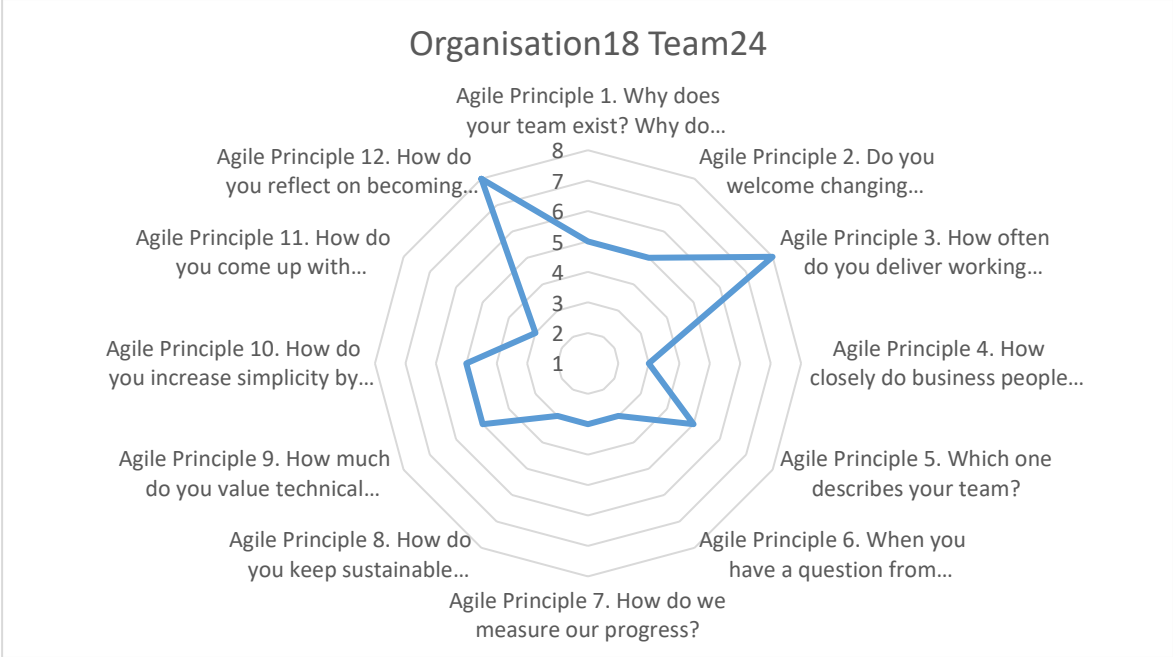
Source: Own work.

The assessment of agile maturity adoption, included the Team25 in the class of medium competency teams, as shown in Figure 37. Please see Table 29 in Appendix 2, which shows the results in greater detail.

As a summary of the assessment of agile maturity adoption, based on the received responses, I calculated the number of the participating teams which had high, medium or low agile competency respectively. The final result was that 17 teams had high agile competency, 7 teams had medium competency, and 1 team had low agile competency, as shown in Figure 38. Please see Table 30 in Appendix 2, which shows the results in greater detail.

Figure 37: Radial diagram for Team25
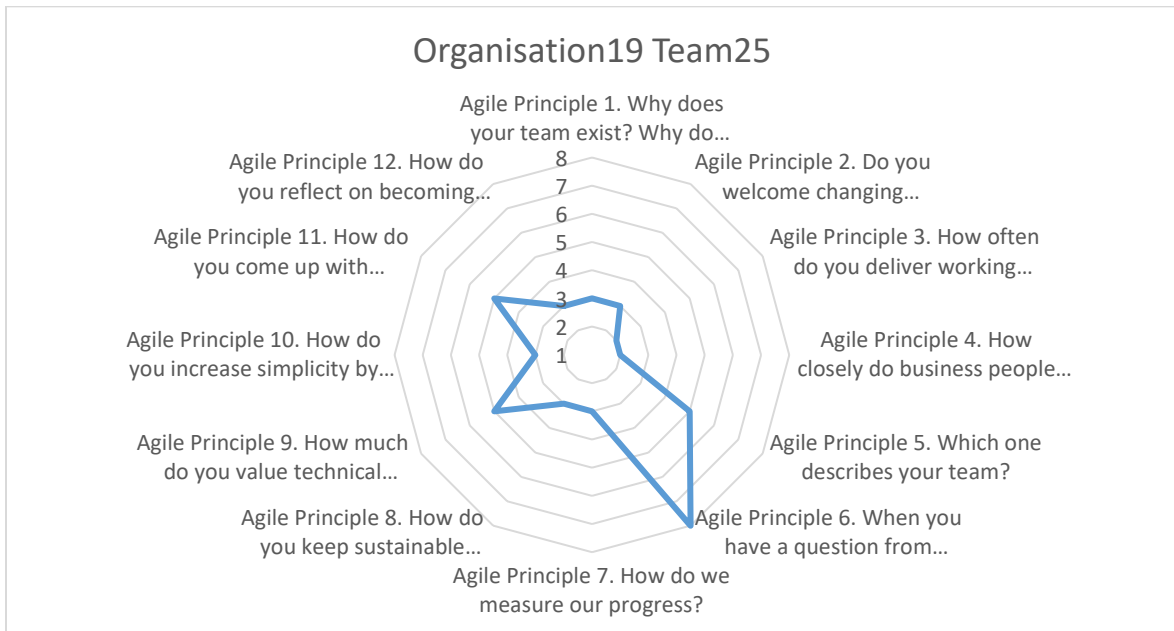
Source: Own work.

Figure 38: Number of teams per level of competency on agile maturity adoption
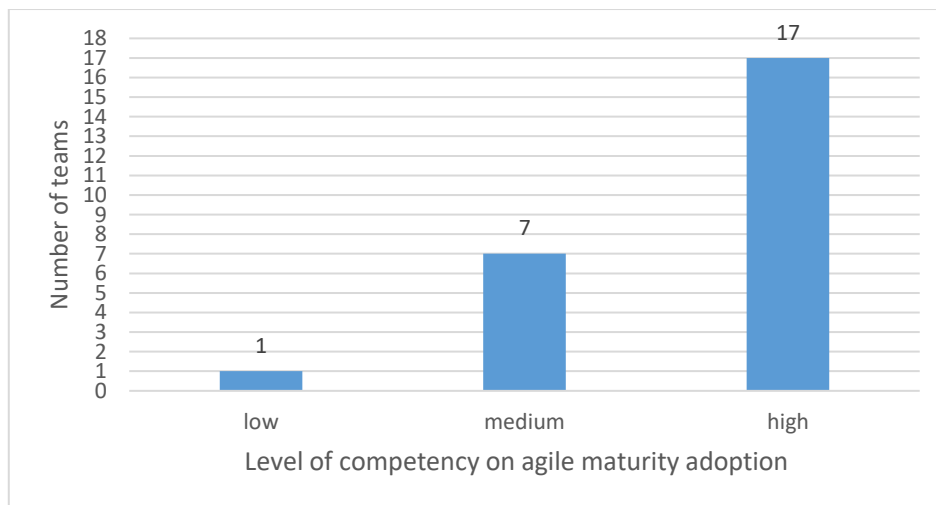
Source: Own work.

5.3.1.3 The third part of the questionnaire – usage of the agile methodology and practices

Following the assessing part of a team agility, at the beginning of the third part of the questionnaire the participants answered the question whether they had used any agile project management practices in their field of work. Given the answers in the survey, 40% of the participants used the agile project management practices "a little" and "a lot", as shown in

Figure 39. Up to 43% of the participants stated that they did not use agile practices heretofore, but were interested in adopting them.

Six of the participants, who stated that they were not interested in using agile practices, worked on 6 different teams, and four of them had a teammate who was interested in using agile practices.

10 teams out of 25 were in the habit of using agile practices whereas additional 13 teams had members, who stated they were interested in using agile practices. More details are given in Table 31, Appendix 2.

Figure 39: Participants using agile practices
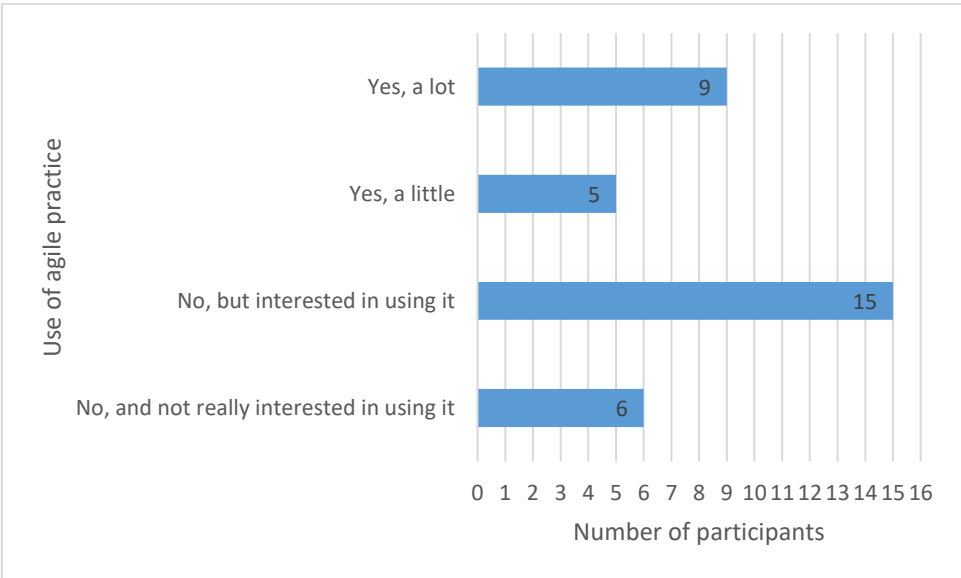
Source: Own work.

Out of fourteen participants using agile methodologies, most of them (64.3%) had used the Scrum methodology, as shown in Figure 40. That is, nine participants out of fourteen, had used the Scrum, as shown in Table 32, Appendix 2.

The rest of the participants, twenty-one in number, did not use any agile methodology. Eighteen of them, answered with multiple choice, when questioned about the reasons why they did not use agile project management methods. The top reason was chosen by eight, out of eighteen participants, stating that "a more structured system is required in our industry." Chosen by six was the reason "lack of available training" and the following three reasons were chosen by 5 participants: "insufficient time to make the change from current methods" or "lack of management support" or "our customer requires a specific approach."

Figure 40: Agile methodology used
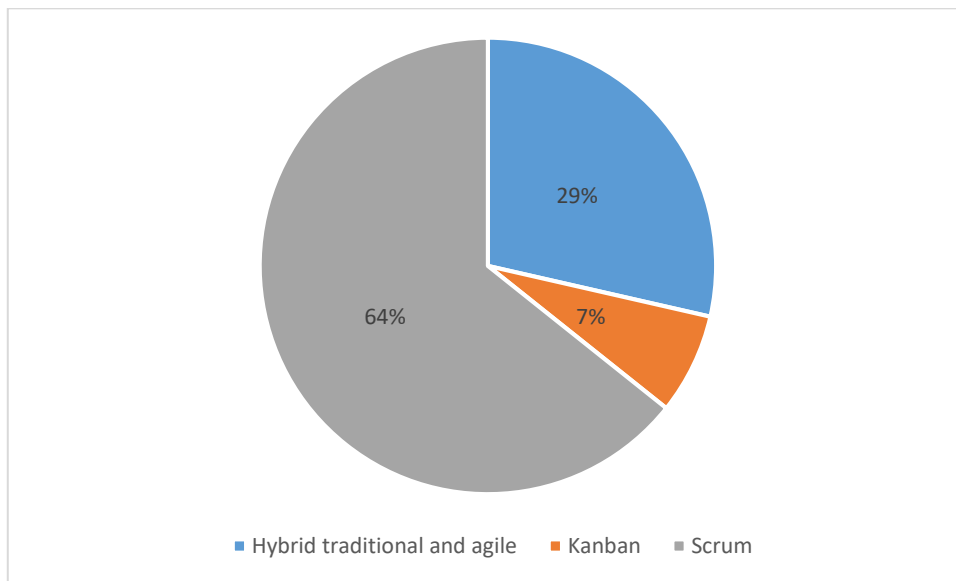
The 92.9% of the participants, who had been using the agile project management practices had been practicing them for longer than a year, and 64.3% of them had been practicing agile for three and more years, as shown in Figure 41. More details are given in Table 33, Appendix 2.

Figure 41: Years of using agile management practices
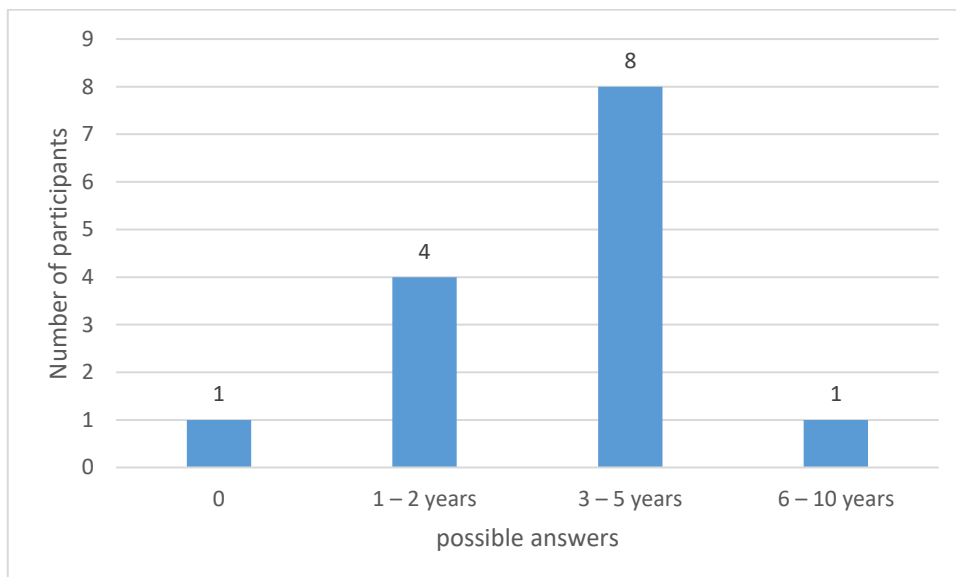
Most of the teams (92.9%) had been using agile project management practices at least occasionally, as shown in Figure 42 and presented in greater detail in Table 34, Appendix 2.

Figure 42: Frequency of using agile practices
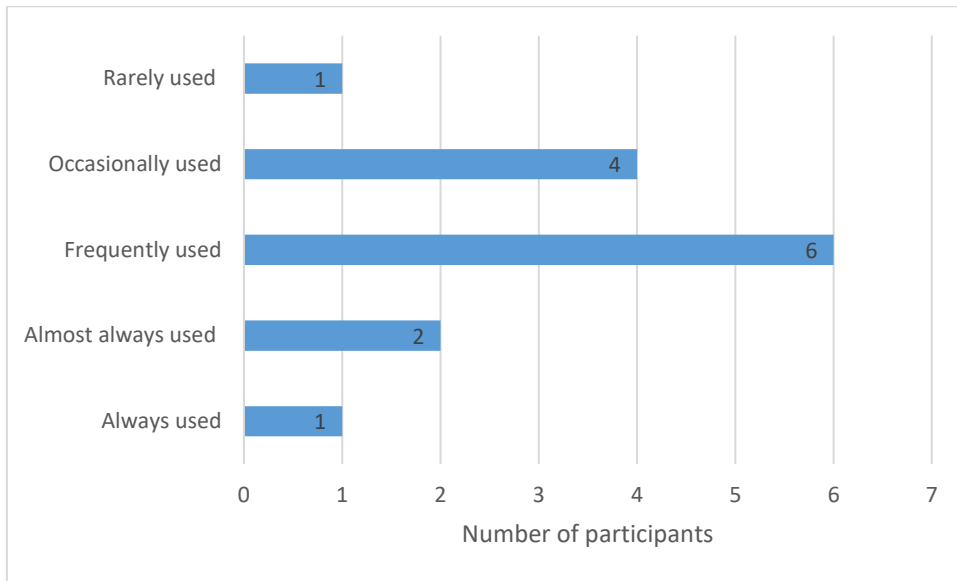
Source: Own work.

As shown in Figure 43 and in greater detail in Table 35, Appendix 2, 50% of the participants used to apply the elaborated agile practices to all types of projects.

Figure 43: Usage of agile practices for managing projects
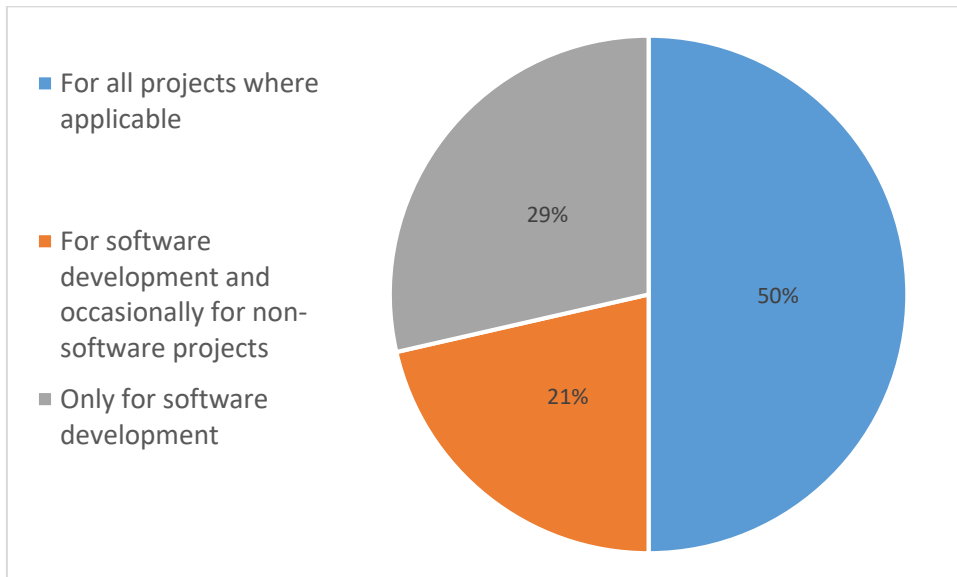
Source: Own work.

The results showed that the top three reasons for the teams to adopt agile practices were the following: to enhance the ability to manage changing priorities, to accelerate software delivery, and to increase productivity, as shown in greater detail in Table 36, Appendix 2. The participants had a multiple-choice options, which were limited to three choices of the list of predefined reasons, and a possibility to add one more reason. Enhancing the ability to

manage changing priorities was pointed as a top reason from eight out of fourteen participants, who had been using the agile practices. The second and the third reason was picked by 7 participants only. The reasons with the least number of points were: two due to the increasing software maintainability, and one due to the enhancing delivery predictability.

Participants highlighted the top three reasons for participants to adopt agile practices as follows: to increase productivity, to accelerate project delivery, and to improve business/IT alignment. Participants could choose only three out of the all proposed reasons. The top reason, to increase productivity was chosen by 8 participants, to accelerate project delivery by 7, and the reason to improve business/IT alignment was chosen by 5 participants. The four reasons that scored the least points were these ones: to improve project visibility, to improve engineering discipline, to enhance delivery predictability, and to accelerate software delivery. A summary of the participants' responses is given in Table 37, Appendix 2.

The top expected benefit of adopting agile practices was the increased team productivity, chosen by ten participants. Following with 7 scored points, was the the ability to manage changing priorities, and the next two scored 6 points: the delivery speed/time to market and software quality. Among the least expected benefits were project cost reductions and team moral. All the responses are presented in Table 38, Appendix 2.

When making an assessment of teams which stated they had been practicing agile, the assessment of agile maturity adoption showed that up to 80% of them were high competency teams, and 20% of them were medium competency teams, as seen in Table 39, Appendix 2. As far as the non-agile teams are concerned, 60% of them were high competency teams, 33.3% of them were medium competency teams, and only 0.7% of them were low competency teams, as shown in Table 40, Appendix 2.

The number of high, medium and low competency teams is shown in Figure 44.

5.3.1.4 The forth part of the questionnaire – the influence of Covid-19 pandemic

In the last part of the questionnaire, I asked the participants about the influence of Covid 19 pandemic on their adoption of agile practices. The next three questions included whether there was an opportunity for the participants to work remotely, whether their team practice to work side-by-side i.e.to work alongside had been changed, and whether there was another team in their organisation that worked remotely. The purpose of these questions was to find out whether there was a real possibility for the team members to work remotely, separately from their team, as Covid 19 pandemic created a new scheme of work. In my own experience, the people who did not work mostly from their homes, had less need to change the way they worked before the pandemic.

Figure 44: Level of competency on agile maturity adoption for teams
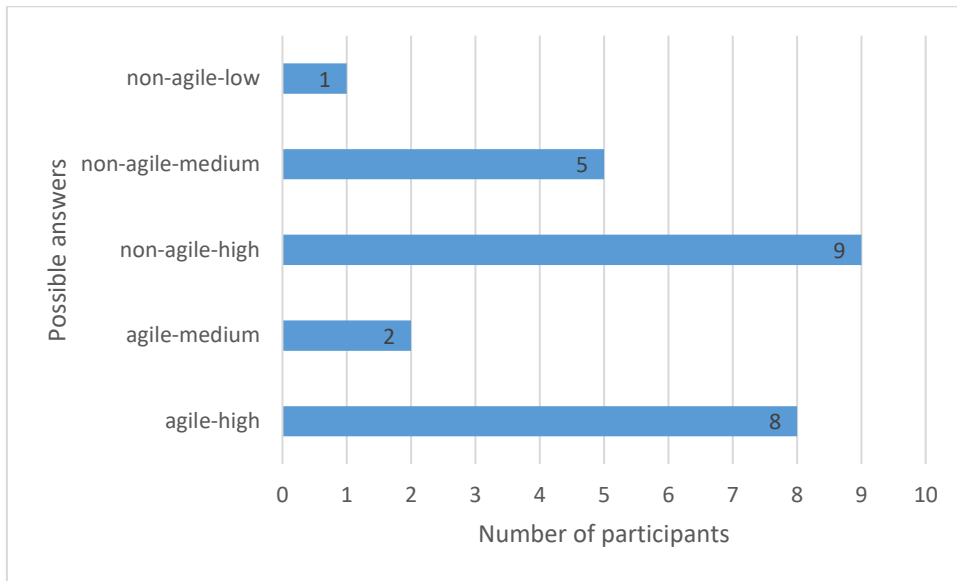
Source: Own work.

A large number of the participants (94.3%), most of the time could work remotely, as their physical presence in the office is not required. Indeed, none of them stated that all-time-presence in the office was required, as shown in Figure 45. More details are given in Table 41, Appendix 2.

Figure 45: Working remotely and not required presence in the office
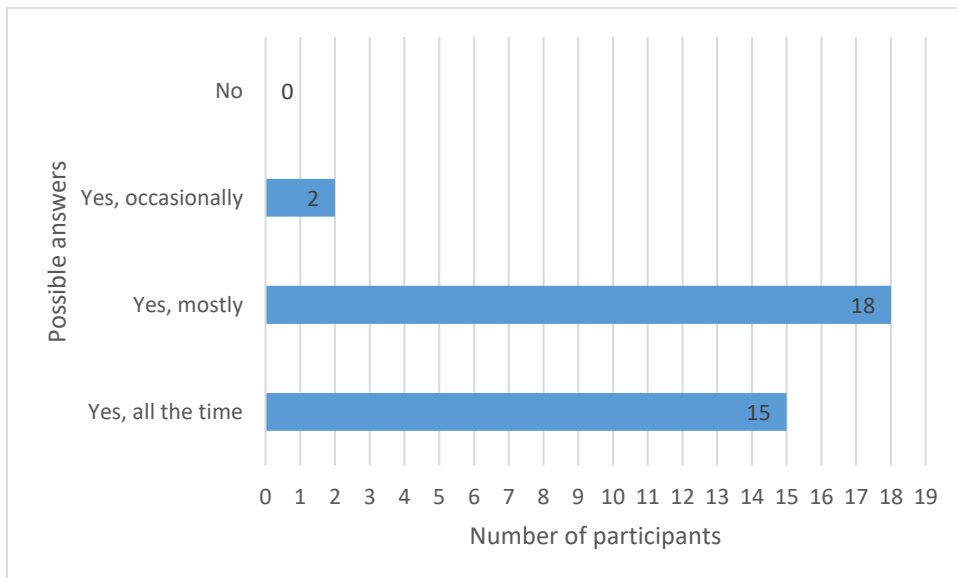
Source: Own work.

Moreover, up to 60% of the participants were on a team that did not work at the same location, as shown in Figure 46. In my opinion, this will again call for more frequent

coordination-meetings and it will also bring the need for better visibility of tasks and projects in general. Their responses are presented in Table 42, Appendix 2.

Figure 46: Working in an agile team that is not in the same location
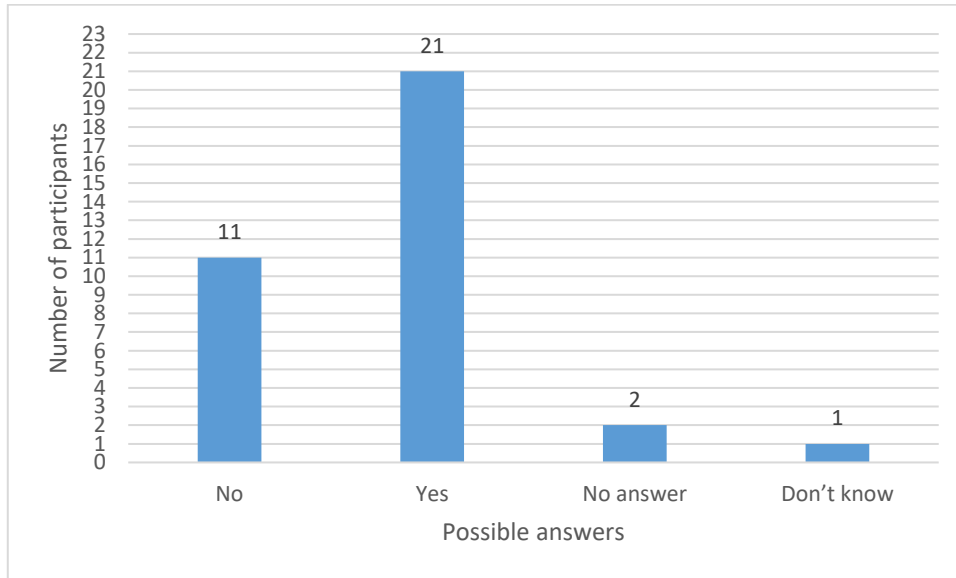
Source: Own work.

Figure 47: Knowing of other teams in their organization that is working remotely and not all members are in the same location
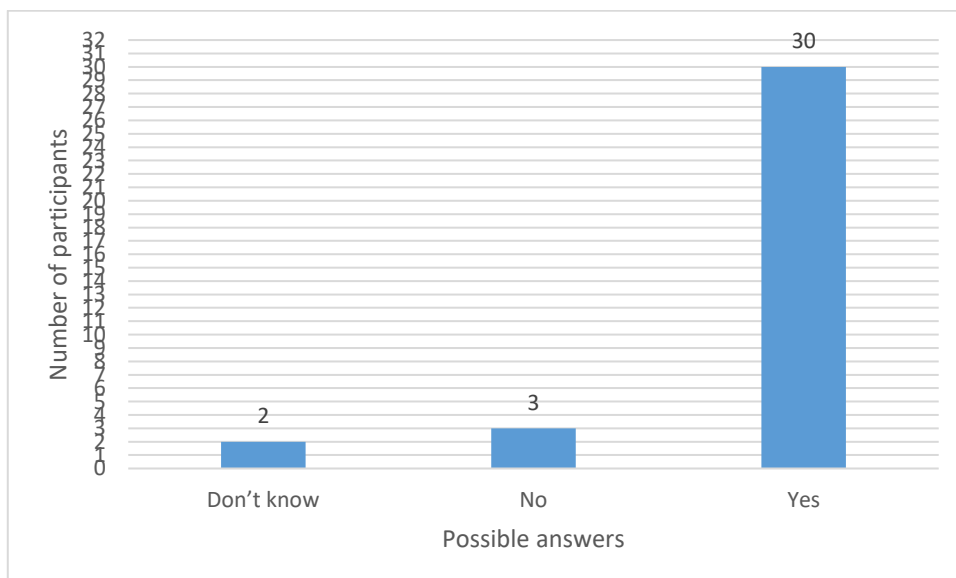
Source: Own work.

Up to 85.7% of the participants were aware of other team working in their organisation, which worked remotely, thus not all team members were present at the same location, as shown in Figure 47, and in greater detail in Table 43, Appendix 2.

Five of the participants answered they had been using a little agile methods/practices prior the Covid-19 pandemic, but in question 17 they stated they were not using agile practices any longer. Two of them had been with their team from 1 to 3 years, which gives the likelihood for these participants to have changed their team or organisation before the pandemic. The other three participants stated that they had been working with their current teammates for over 4 years, which I will consider as a preparation period to start using agile practices in their team. In support of this statement is also the fact that the pandemic had caught interest and had accelerated agile adoption in their team.

The responses are shown in the summary in Figure 48 and in Table 44, Appendix 2.

Figure 48: Using agile methods/practices before Covid-19 pandemic
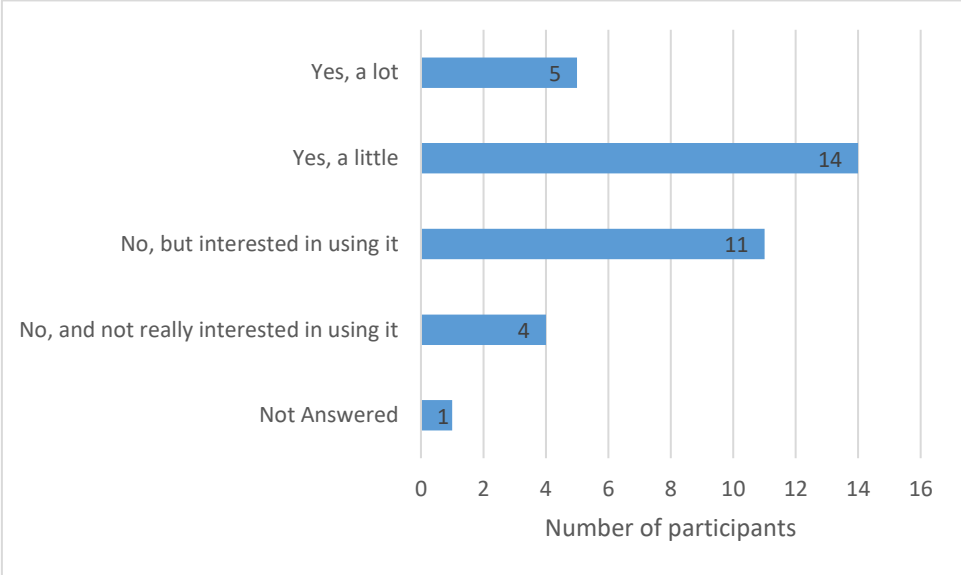
Source: Own work.

Another 82.9% of the participants stated that the Covid-19 pandemic had also attracted interest or had accelerated agile adoption in their team, as shown in Figure 49 and in Table 45, Appendix 2.

Figure 49: Covid-19 pandemic affected teams' adaption of agile methods/practices
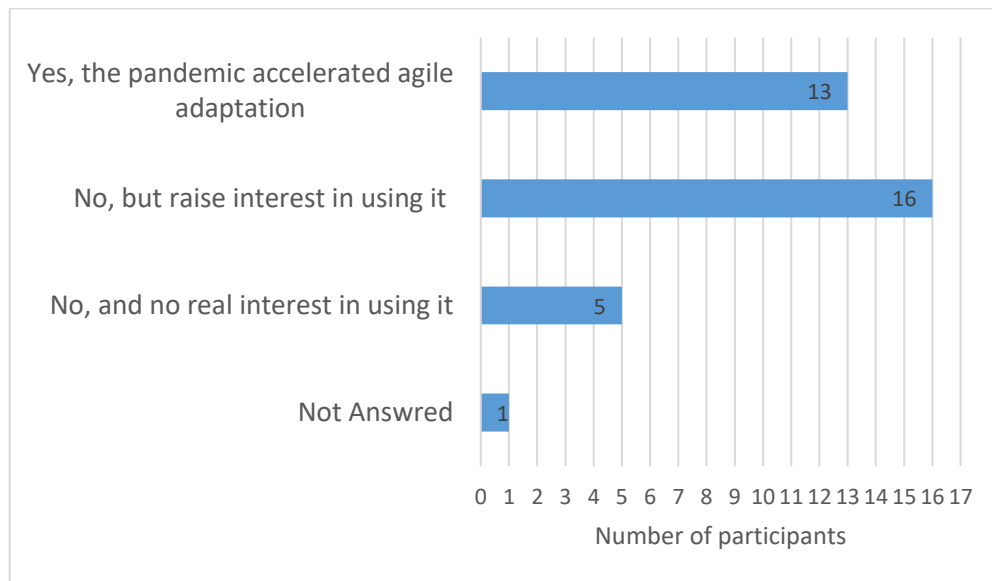
Source: Own work.

The next three questions were open-end questions. These questions were answered by satisfying 31 out of 35 participants. The first question asked the participants about the project management challenges their team had faced during the Covid-19 outburst. Participants who had been using the agile project management practices emphasised the distance as a challenge among team members as they need a close collaboration and frequent meetings. For illustration, participant P9 emphasised the challenge of not being able of *"working together as a team and building a friendly and outgoing team which can collaborate, help and share ideas."*

The other participant P14, emphasised that the *"Collaboration was challenging, it's more productive to have face-to-face meeting and not to be disturbed by background noise and interruptions."*

The participants that did not use agile practices faced the challenge to organise the work remotely and still maintain visibility over project execution. In participant P1's book, the challenge was this one: *"At the beginning instructing each person in our department to work remotely, and then adapting all of us to work with the same efficiency as before (in the office)."* Participant P29 uttered the challenge of *"adjusting to the new way of working, of how to establish a long-distance communication, of how to organise activities, of how to organise teams, of how to implement projects, of how to compensate for the lack of human resources, of how to optimise the planning and use of materials and equipment, and the challenge of meeting the targets within the given deadline."*

It is worth stating once again that all teams faced the challenge of isolation and possible unavailability of some team members because of infection with Covid-19. For example, P14

wrote that they *"needed to consider that situation when any team member would be possibly unavailable during a short-to-mid time period if infected."*

On the other hand, the tasks that needed physical presence in the office brought up logistical and health protection issues. For example, participant P11 wrote that *"The team was most affected during Covid-19 time because we use physical devices to test our products and services, so we had to be in the office sometimes even during the lockdown.''* Similarly, participant P23 wrote that the Covid-19 pandemic posed logistical problems such as *"delivering on site products and services on time, with reduced possibility for travelling and physical presence."*

Teams had increased number of meetings. Participant P34 wrote that they had *"too many meeting with client and internal meetings to properly prioritise, develop, test and deploy to production all requests from customers, to fix bugs and to prepare new product releases."* Participant P3 emphasised the *"time constraint due to phone/online coordination requirements."*

The next question was to learn about the actions taken by the participants to overcome challenges posed by the Covid-19 pandemic. Thus, I found out that all teams succeeded to increase communication by having more frequent online meetings. For example, participant P14 wrote that they practised *"more closely and frequently team meetings, support, and empathy."* Other participant, marked P26, wrote: *"We held short meetings more regularly in order to keep all of the questions answered and all the tasks under control."* Similarly, participant P35 pointed out: *"We switched our work completely online, including internal meetings with our technical teams as well as with our existing and potential clients."*

The teams that had not implemented any agile methodology to overcome challenges of Covid-19 pandemic started having daily meetings. For example, participant P7 shared that they have started having a *"daily meetings to present advances in the projects."*

With the last question, I sought to understand whether Covid-19 pandemic affected participants' adoption of agile practices, and if so, how. Six of the participants stated that Covid-19 pandemic had accelerated their adoption of the agile methodologies, such that three of them were part of the teams that had not implemented agile methodologies yet, and other three had already implemented agile. The rest of the participants clearly stated that Covid-19 pandemic did not affect their adoption of agile practices.

6 DISCUSSION

The result of the data analysis is that 17 teams are high agile competency teams, 7 teams are medium and 1 team is low agile competency team. For the 10 teams that use agile practices, it is well expected to have high or medium competency of agile adoption. As most of the other teams have members who stated that they are interested in using agile practices in the

future, the fact that most of these agile adoption teams are high and medium competency teams will not come as a surprise. It is expected that these participants are familiar with agile practices, although they do not state a constant usage of them. However, considering the data obtained by comparison of the results of teams practising agile and the results of the assessment of the agile maturity adoption level, it is evident that teams which practise agile have a higher percent of high competency teams. This was expected on my part as a researcher as they are more familiar with the agile principles and agile practices, and they also apply most of the agile principles. What might be surprising is that even though most of the participants stated that they are interested in practising agile and most of their team assessment showed that they have reached the high or medium level of agile maturity adoption, during Covid-19 pandemic they did not start using agile practices.

The results of my research show that 40% of participants had used agile project management practices and additional 43% were interested in using these practices. Yet, these results do not provide a benchmark for the entire service industry in North Macedonia since I dealt with only 19 organisations and 25 teams. However, I had a high percentage of participants who used or became interested in using agile practices, a fact which could be taken as a good reference point that the service industry in North Macedonia is very much aware of agile practices and it is striving towards agile transformation. In the participants using agile methodologies, the most used methodology is Scrum with 64.3%, such that 9 out of 14 participants using agile practices are using the Scrum one. According to Digital.ai (2020) in their 14th annual survey report 58% of participants use Scrum, and additional 18% use ScrumBan and Scrum/XP hybrid, which shows that the service industry in North Macedonia is not staying behind the world trend.

At the end of my research I found that there are top three reasons for participants' team to adopt agile practices, and these are: enhancing ability to manage changing priorities, accelerating software delivery, and increasing productivity. Conspicuously, these are the same as the top reasons for adopting Agile, according to Digital.ai (2020) in the 14th annual state of agile report: accelerating software delivery, enhancing ability to manage changing priorities and increasing productivity. In the answers to the next question in the same part of the questionnaire, I found that the top three expected benefits of adopting the agile practices by my participants are: increased team productivity; ability to manage changing priorities and delivery speed/time to market. According Digital.ai (2020) these are: the top 6th reason, the top 1st reason and the top 4th reason. This finding shows that teams that adopted agile framework have similar reasons, expectations and priorities.

Most of the assessment models are intended for teams that have been practising agile to start the process of improvement. In this research paper, I assessed the agility adoption of project teams that are an integral part of the service industry and I did not expect that they had already become agile, and moreover they would like to be assessed on agile maturity. I tried to assess agility trough assessing their team behaviour on the basis of 12 agile principles. In the relevant literature, I could not find similar research where a scholar attempts to assess

the overall agility of certain industry. All the research in the literature I came across focuses on assessing teams that had asserted themselves as agile practitioners, and they need assessment of the level of their agile maturity as well as their possibilities for improvement. Most of the agile maturity assessment models are based on measuring the level of agility through assessing the adoption of agile practices. In my research, I considered the assessment of maturity on adoption of agile practices as an inappropriate approach as some of the teams were not aware of agile practices and their meaning and expectations. For this obvious reason, I decided to use a more basic approach and adopted an available questionnaire, founded on 12 agile principles. The available questionnaire was the closest to what I aspired to research as agile principles are the basis of most of the agile practices and methodologies. Having in mind that a team can be agile by complying with the agile principles, I did my research on a team agile maturity by using, and slightly adopting, the available questionnaire. I also expect that any future research could be done using this particular questionnaire.

The biggest challenge of mine was to gather data needed for the survey i.e. to get business information on participants who were part of the same team in the organisation while not collecting any personal data about the participants and the organisation. Should this type of data be collected, the anonymity would be broken, and participants may certainly refrain from participating in the survey. If this critical requirement could be met, the survey could have much bigger number of participants, and would probably have more relevant information on the industry segment. Right before I started the survey, I talked to a multitude about the possibility of gathering information in their organisation and revealing the company name or logo, but the response was that it might take a long time to get approval from their management. They even expected that the management might consider the information as confidential, thus there was a big chance for my proposal to be refused.

Most of the answers I received from telecommunications and service-dealing industry. From the participants that received my questionnaire, I expected more responses from the finance sector, but unfortunately I did not receive the done survey back. By getting the responses from the financial organisations, I hoped to question a group of more diversified participants.

For the future research, one way to get more responses is to conduct a survey without taking into consideration the team and the exact organisation within which the team operates, but only to focus on personal responses of the participants, gathered in a certain industry segment. Another good approach is that further research could be conducted through the chamber of commerce of a certain industry so as to try to ease the process of getting the consent of the organisations. Perhaps, it could be equally good if the survey is distributed on events organised by a specific industry sector. If there was only one additional question asking for the name of the organisation in which the participant works, it would be hard to predict whether it will lower the number of responses, as the participants might consider that exact information as a possible personal information, not to be willingly revealed in the

survey. As I sent the survey to people of my circle, my goal was not to put them in a position where disclosing of the name of the organisation might pose a problem with their employer.

CONCLUSION

Covid-19 has posed further challenges to the business environment that require companies to adjust quickly. Agile mind-set shows new paradigm of problem solving that ought to help companies and organisations to be in agreement with the new business conditions. Agile practices should be readily embraced since they promote breaking complex problems into small tasks and into iterations that put the most important task first in order, allowing for organisations to pivot quickly towards the most important issues for the customer and the stakeholders alike.

In view of the results of my research, I am able to conclude that the level of implementation of agility in the service industry is high, since most of the assessed teams have provided a benchmark for high or medium competency in agile adoption. Most certainly, there is a lot of room for improvement in all teams, hence this research could be used by varied organisations in order to start or to improve their agile adoption. Please bear in mind that although a team is considered agile by complying with the standard agile principles and also by not using any agile framework, my opinion is that for any team it is much better to start adoption of an agile framework. In fact, an agile framework is a guidance on the process of agile methodology adoption and helps the team by giving certain proven guidelines towards agile transformation. Later on, the team could use an agile maturity assessment tool to assess the teams' agility adoption as well as use it as a process for improving agile adoption.

While most of the participants stated that Covid-19 pandemic had no considerable impact on the implementation of agile practices in their team, I am positive that in the upcoming few years there will be ever more organisations adopting agile practices in order for them to have a better project visibility and to maintain team productivity. As new "normal" becomes working from home and becoming a part of a remotely-located team, the agile frameworks could help by overcoming the expected challenges. The Covid-19 pandemic accelerated the new normal and made most of the organisations aware of globalisation of the workforce market i.e. it changed their usual perception of a workplace. According to Digital.ai (2020), 95% of organisations are already using agile development methods. However, 82% of the respondents stated that their organisation incorporates other teams, which do not practise agile practices, showing that there is room for further improvement. In the same report, 81% of the participants stated that their organisation also encompasses agile teams not working at the same location.

To sum up, the increased use of APM in the last ten years due to its evident effectiveness as well as to the Covid-19 pandemic allows me to reasonably expect that the usage of APM will be promoted even more beyond the limits of software development. This will most

certainly increase the motivation for deeper research in order to confirm the far-reaching benefits of this breakthrough concept which should not be limited to the project management only. As a matter of fact, the comprehensive research done should encourage and stimulate a greater number of organizations and companies to start putting APM into practice as soon as possible, and also to further develop this concept.

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APPENDICES

Appendix 1: Povzetek (Summary in Slovenian)

Projektni management se nenehno spreminja, razvija in izboljšuje, organizacije pa se morajo omenjenim spremembam čim hitreje prilagajati. Sodobno poslovno okolje, zaznamovano z agresivno konkurenco ter hitro spreminjajočimi se razmerami in potrebami na trgu, namreč zahteva hiter odziv vseh deležnikov na trgu. Agilni projektni management poudarja fleksibilnost z iterativnim in prilagodljivim pristopom. Poudarja pomen kratkih povratnih zankah, osredotočenih na stranke, samoorganizirajočih se in interdisciplinarnih timih, preglednosti sodelovanja in napredka dejavnosti ter osebne komunikacije. Ključno prednosti agilnega projektnega managementa predstavlja sposobnost obvladovanja kompleksnosti, negotovosti in sprememb (Schmidtner, Doering, & Timinger, 2021).

Širjenje akutnega respiratornega sindroma koronavirus 2 (SARS-CoV-2) je doseglo razsežnosti pandemije, ki vpliva na vse poslovne procese. Pandemija je med drugim pomembno vplivala tudi na stopnjo negotovosti v projektnem okolju, odziv strank na pandemijo, sposobnost timov za delo na daljavo, razvoj infrastrukture in na delo dobaviteljev (de Camara, et al., 2020). Organizacije se trudijo najti ustrezne načine za spopadanje s temi novimi izzivi. Hitre spremembe v poslovnem okolju nenehno povzročajo turbulence v procesu načrtovanja in odločanja organizacij. Agilne metode bi lahko pomagale organizacijam, da se odzovejo na negotovost, ki jo povzroča COVID-19 pandemija.

Namen te raziskave je posledično preučiti vpliv COVID-19 pandemije na implementacijo agilne metodologije v storitvenih organizacijah, poglobiti razumevanje proučevane tematike in s tem pomagati storitvenim organizacijam, da izboljšajo način delovanja v negotovem okolju. Cilj magistrske naloge je pregledati literaturo o agilnem projektnem managementu in metodologijah, preučiti vpliv COVID-19 na izvajanje agilnih praks v storitvenih organizacijah in razumeti, kako so se storitvene organizacije odzvale na negotovosti v času pandemije.

V magistrskem delu predstavim rezultate primarne raziskave, izvedene s pomočjo anketiranja timov, ki so zaposleni v storitvenih organizacijah. V raziskavi je sodelovalo 35 zaposlenih, ki delajo v 25 timih v storitvenih organizacijah v Republiki Severni Makedoniji. V okviru raziskave sem želel preučiti, ali projektni timi vodijo projekte na agilen način, kakšen je bil vpliv COVID-19 pandemije na njihov interes za uporabo agilnih pristopov in praks ter kako je pandemija vplivala na njihov način dela.

Rezultat raziskave kažejo, da je 17 timov visoko agilnih, 7 timov srednje agilnih in 1 tim nizko agilen. Primerjava rezultatov za time, ki uporabljajo agilne pristope, z oceno stopnje zrelosti uvajanja agilnosti kaže, da imajo timi, ki uporabljajo agilne metode višji odstotek visoko kompetentnih timov. Rezultati hkrati kažejo, da čeprav je večina zaposlenih zainteresiranih za uporabo agilnih metod in večina timov dosega visoko ali srednjo stopnjo zrelosti pri uvajanju agilnosti, večina timov med COVID-19 pandemijo ni začela na novo uporabljati agilnih praks. Rezultati raziskave kažejo, da je 40 % udeležencev uporabljalo

agilne prakse pri vodenja projektov, dodatnih 43 % pa jih je bilo zainteresiranih za uporabo teh praks. Ugotovil sem, da so trije glavni razlogi, zakaj preučevane organizacije uvajajo agilne prakse, naslednji: izboljšanje sposobnosti upravljanja spreminjajočih se prioritet, pospeševanje dostave programske opreme in povečanje produktivnosti. Tri največje pričakovane prednosti sprejemanja agilnih praks pa so: višja timska produktivnost; sposobnost upravljanja spreminjajočih se prioritet in hitrosti/časa dostave na trg. V okviru raziskave sem zbral tudi podatke o vplivu COVID-19 pandemije na opravljanje dela v storitvenih organizacijah. Rezultati raziskave kažejo, da je 94,3 % udeležencev večino časa delalo od doma. Poleg tega so se vsi timi soočali z izzivom izolacije in morebitne nedostopnosti posameznih članov tima zaradi bolezni COVID-19. V času COVID-19 so se timi soočali s povečanim številom sestankov, s pomočjo katerih so ohranjali redno komunikacijo. Šest udeležencev je bilo mnenja, da je COVID-19 pandemija pospešila njihovo uvajanje agilnih metod. Preostali udeleženci so menili, da COVID-19 pandemija ni vplivala na njihovo uvajanje agilnih metod.

Medtem ko je bila večina udeležencev mnenja, da COVID-19 pandemija ni imela pomembnega vpliva na implementacijo agilnih praks v njihovi timih, sem prepričan, da bodo organizacije v prihodnjih letih čedalje bolj pogosto uporabljale tovrstne prakse z namenom, da bodo izboljšale vidljivost svojih projektov in ohranjale visoko stopnjo timske produktivnosti. Agilni pristopi lahko namreč pomagajo organizacijam pri premagovanju izzivov, ki jih prinaša nova realnost, zaznamovana z delom od doma in vključenostjo v oddaljene time. Povečana uporaba agilnega projektnega managementa v zadnjih desetih letih zaradi njegove očitne učinkovitosti namreč nakazuje, da se bo uporaba agilnega pristopa pri vodenju projektov še bolj spodbujala tudi izven meja razvoja programske opreme.

Appendix 2: Tables from data analisys of responses from survey

Table 3: Respondents working experience in their current team

Organisation	Team	<1 year	1 – 3 years	4 – 9 years	10 – 15 years	15+
Org1	T1		1			
Org2	T13			1		2
	T15				2	
	T19			1		
	T2		1		1	
	T20		1			
	T3				1	
	T9		1		1	
Org3	T4			1	1	
Org4	T5	1				
Org5	T6		1			
Org6	T7		1			
Org7	T8	1				
Org8	T10	1		1		
Org9	T11		1		1	
Org10	T12	1				
Org11	T14		2			
Org12	T16				1	
Org13	T17					1
Org14	T18			2		
Org15	T21		1			
Org16	T22		1			
Org17	T23	1				
Org18	T24				1	
Org19	T25		1			
Grand Total		5	12	6	9	3

Source: Own work.

Table 4: Respondents occupation

Organisation	Team	Customer Support	Finance, Purchasing, HR, or other supporting role	Project Office	Sales & Marketing	Technical Department
Org1	T1					1
Org2	T13			3		
	T15					2
	T19					1

	T2					2
	T20					1
	T3		1			
	T9					2
Org3	T4					2
Org4	T5					1
Org5	T6					1
Org6	T7					1
Org7	T8					1
Org8	T10	1				1
Org9	T11				1	1
Org10	T12					1
Org11	T14					2
Org12	T16					1
Org13	T17					1
Org14	T18					2
Org15	T21					1
Org16	T22					1
Org17	T23					1
Org18	T24				1	
Org19	T25					1
Grand Total		1	1	3	2	28

Source: Own work.

Table 5: Responses on agile maturity of Team1

Organisation	Org1
Team1	P1
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	3
Agile Principle 3. How often do you deliver working solution to the customer/client?	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	3
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5
Agile Principle 7. How do we measure our progress?	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	5
Agile Principle 9. How much do you value technical excellence?	3

Agile Principle 10. How do you increase simplicity by maximising the work not done?	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5

Source: Own work.

Table 6: Responses on agile maturity of Team2

Organisation	Org2	Org2	Org2
Team2	T2	P2	P6
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	3	3	3
Agile Principle 2. Do you welcome changing requirements?	5	5	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	4	5	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	3,5	2	5
Agile Principle 5. Which one describes your team?	2,5	2	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5,5	3	8
Agile Principle 7. How do we measure our progress?	2,5	3	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	2,5	2	3
Agile Principle 9. How much do you value technical excellence?	2	2	2
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5	5	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3,5	2	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	2,5	2	3

Source: Own work.

Table 7: Responses on agile maturity of Team3

Organisation	Org2
Team3	P3
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	1
Agile Principle 2. Do you welcome changing requirements?	5

Agile Principle 3. How often do you deliver working solution to the customer/client?	8
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5
Agile Principle 7. How do we measure our progress?	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	5
Agile Principle 9. How much do you value technical excellence?	8
Agile Principle 10. How do you increase simplicity by maximising the work not done?	8
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	1
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5

Source: Own work.

Table 8: Responses on agile maturity of Team4

Organisation	Org3	Org3	Org3
Team4	T4	P4	P35
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	6,5	8	5
Agile Principle 2. Do you welcome changing requirements?	6,5	8	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	4	5	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	4	3	5
Agile Principle 5. Which one describes your team?	4	5	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8	8	8
Agile Principle 7. How do we measure our progress?	2,5	2	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	4	5	3
Agile Principle 9. How much do you value technical excellence?	4	5	3
Agile Principle 10. How do you increase simplicity by maximising the work not done?	4	5	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3	3	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	4	5	3

Source: Own work.

Table 9: Responses on agile maturity of Team5

Organisation	Org 4
Team5	P5
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	5
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	8
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	8
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	8
Agile Principle 9. How much do you value technical excellence?	8
Agile Principle 10. How do you increase simplicity by maximising the work not done?	8
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5

Source: Own work.

Table 10: Responses on agile maturity of Team6

Organisation	Org 5
Team6	P7
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	5
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	1
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	3
Agile Principle 7. How do we measure our progress?	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	1

Agile Principle 9. How much do you value technical excellence?	1
Agile Principle 10. How do you increase simplicity by maximising the work not done?	1
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	1
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	1

Source: Own work.

Table 11: Responses on agile maturity of Team7

Organisation	Org 6
Team7	P8
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	5
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	8
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	5
Agile Principle 9. How much do you value technical excellence?	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	2
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	3

Source: Own work.

Table 12: Responses on agile maturity of Team8

Organisation	Org7
Team8	P9
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	8
Agile Principle 3. How often do you deliver working solution to the customer/client?	5

Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	2
Agile Principle 5. Which one describes your team?	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	3
Agile Principle 7. How do we measure our progress?	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	3
Agile Principle 10. How do you increase simplicity by maximising the work not done?	1
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	3

Source: Own work.

Table 13: Responses on agile maturity of Team9

Organisation	Org2	Org2	Org2
Team9	T9	P29	P33
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	3,5	2	5
Agile Principle 2. Do you welcome changing requirements?	4	3	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	8	8	8
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	1,5	2	1
Agile Principle 5. Which one describes your team?	3,5	2	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5	2	8
Agile Principle 7. How do we measure our progress?	2	2	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	2	2	2
Agile Principle 9. How much do you value technical excellence?	2	2	2
Agile Principle 10. How do you increase simplicity by maximising the work not done?	1,5	2	1
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3	5	1
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	1,5	2	1

Source: Own work.

Table 14: Responses on agile maturity of Team10

Organisation	Org8	Org8	Org8
Team10	T10	P11	P34
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8	8	8
Agile Principle 2. Do you welcome changing requirements?	3,5	2	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	5,5	8	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	4	5	3
Agile Principle 5. Which one describes your team?	4	5	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5	8	2
Agile Principle 7. How do we measure our progress?	3	3	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	4	5	3
Agile Principle 9. How much do you value technical excellence?	8	8	8
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5,5	8	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	4	3	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5	5	5

Source: Own work.

Table 15: Responses on agile maturity of Team11

Organisation	Org9	Org9	Org9
Team11	T11	P12	P32
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	6,5	8	5
Agile Principle 2. Do you welcome changing requirements?	5,5	8	3
Agile Principle 3. How often do you deliver working solution to the customer/client?	3	3	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	2,5	2	3
Agile Principle 5. Which one describes your team?	4	5	3

Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5	5	5
Agile Principle 7. How do we measure our progress?	2,5	2	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3	3	3
Agile Principle 9. How much do you value technical excellence?	5	5	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	4,5	1	8
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3	3	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	6,5	8	5

Source: Own work.

Table 16: Responses on agile maturity of Team12

Organisation	Org10
Team12	P13
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	5
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5
Agile Principle 7. How do we measure our progress?	5
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	2
Agile Principle 9. How much do you value technical excellence?	3
Agile Principle 10. How do you increase simplicity by maximising the work not done?	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5

Source: Own work.

Table 17: Responses on agile maturity of Team13

Organisation	Org 2	Org 2	Org 2	Org2
Team13	T13	P10	P14	P28
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8	8	8	8
Agile Principle 2. Do you welcome changing requirements?	5	8	5	3
Agile Principle 3. How often do you deliver working solution to the customer/client?	5	8	3	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	6	8	5	5
Agile Principle 5. Which one describes your team?	5	8	5	2
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	7	8	8	5
Agile Principle 7. How do we measure our progress?	4	8	2	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	5	8	5	2
Agile Principle 9. How much do you value technical excellence?	4	8	2	2
Agile Principle 10. How do you increase simplicity by maximising the work not done?	6	5	8	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5	5	5	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	2	2	1	2

Source: Own work.

Table 18: Responses on agile maturity of Team14

Organisation	Org11	Org11	Org11
Team14	T14	P15	P19
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8	8	8
Agile Principle 2. Do you welcome changing requirements?	5	5	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	5	8	2
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	4	5	3
Agile Principle 5. Which one describes your team?	7	5	8

Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5	5	5
Agile Principle 7. How do we measure our progress?	3	2	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	4	3	5
Agile Principle 9. How much do you value technical excellence?	7	8	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5	5	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	4	5	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	3	3	3

Source: Own work.

Table 19: Responses on agile maturity of Team15

Organisation	Org 2	Org 2	Org 2
Team15	T15	P16	P31
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	5,5	8	3
Agile Principle 2. Do you welcome changing requirements?	2,0	2	2
Agile Principle 3. How often do you deliver working solution to the customer/client?	5,5	8	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	3,5	5	2
Agile Principle 5. Which one describes your team?	4,0	5	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5,5	8	3
Agile Principle 7. How do we measure our progress?	8,0	8	8
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	4,0	5	3
Agile Principle 9. How much do you value technical excellence?	5,0	5	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5,0	2	8
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	6,5	5	8
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	3,0	3	3

Source: Own work.

Organisation	Org12
Team16	P17
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	8
Agile Principle 3. How often do you deliver working solution to the customer/client?	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	5
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	5
Agile Principle 9. How much do you value technical excellence?	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	8
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	8
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	8

Source: Own work.

Table 21: Responses on agile maturity of Team17

Organisation	Org13
Team17	P18
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	5
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	5
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	2
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	3

Agile Principle 10. How do you increase simplicity by maximising the work not done?	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	2

Source: Own work.

Table 22: Responses on agile maturity of Team18

Organisation	Org14	Org14	Org14
Team18	T18	P20	P25
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8,0	8	8
Agile Principle 2. Do you welcome changing requirements?	6,5	8	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	4,5	8	1
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	3,0	5	1
Agile Principle 5. Which one describes your team?	5,0	5	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	6,5	5	8
Agile Principle 7. How do we measure our progress?	3,0	5	1
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3,0	5	1
Agile Principle 9. How much do you value technical excellence?	4,5	8	1
Agile Principle 10. How do you increase simplicity by maximising the work not done?	4,5	8	1
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5,0	5	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	4,5	8	1

Source: Own work.

Table 23: Responses on agile maturity of Team19

Organisation	Org 2
Team19	P21
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8

Agile Principle 2. Do you welcome changing requirements?	8
Agile Principle 3. How often do you deliver working solution to the customer/client?	8
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	2
Agile Principle 5. Which one describes your team?	3
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	8
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	8

Source: Own work.

Table 24: Responses on agile maturity of Team20

Organisation	Org2
Team20	P22
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	1
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5
Agile Principle 7. How do we measure our progress?	5
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	3
Agile Principle 10. How do you increase simplicity by maximising the work not done?	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	2

Source: Own work.

Table 25: Responses on agile maturity of Team21

Organisation	Org15
Team21	P23
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	8
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	3
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5
Agile Principle 7. How do we measure our progress?	8
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	2
Agile Principle 10. How do you increase simplicity by maximising the work not done?	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	8
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	2

Source: Own work.

Table 26: Responses on agile maturity of Team22

Organisation	Org16
Team22	P24
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	2
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	2
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	2
Agile Principle 9. How much do you value technical excellence?	8

Agile Principle 10. How do you increase simplicity by maximising the work not done?	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5

Source: Own work.

Table 27: Responses on agile maturity of Team23

Organisation	Org17
Team23	P26
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	8
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	3
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	5
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	5
Agile Principle 7. How do we measure our progress?	5
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	5
Agile Principle 9. How much do you value technical excellence?	3
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	5

Source: Own work.

Table 28: Responses on agile maturity of Team24

Organisation	Org18
Team24	P27
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	5
Agile Principle 2. Do you welcome changing requirements?	5
Agile Principle 3. How often do you deliver working solution to the customer/client?	8
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	3

Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	3
Agile Principle 7. How do we measure our progress?	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	5
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	3
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	8

Source: Own work.

Table 29: Responses on agile maturity of Team25

Organisation	Org19
Team25	P30
Agile Principle 1. Why does your team exist? Why do you come to work every morning? Is it to deliver features for the product? Is it to generate profit for the company?	3
Agile Principle 2. Do you welcome changing requirements?	3
Agile Principle 3. How often do you deliver working solution to the customer/client?	2
Agile Principle 4. How closely do business people (product owner, business or customer representatives) and team members work together in your team?	2
Agile Principle 5. Which one describes your team?	5
Agile Principle 6. When you have a question from someone, or you want to inform someone of something, what is your preferred approach in most cases?	8
Agile Principle 7. How do we measure our progress?	3
Agile Principle 8. How do you keep sustainable constant development speed indefinitely?	3
Agile Principle 9. How much do you value technical excellence?	5
Agile Principle 10. How do you increase simplicity by maximising the work not done?	3
Agile Principle 11. How do you come up with architecture, requirements, and design of the product and services?	5
Agile Principle 12. How do you reflect on becoming more effective and adjust your behavior?	3

Source: Own work.

Table 30: Level of competency on agile maturity adoption

Team	low	medium	high
Team1			1
Team2		1	
Team3			1
Team4			1
Team5			1
Team6	1		
Team7			1
Team8		1	
Team9		1	
Team10			1
Team11		1	
Team12			1
Team13			1
Team14			1
Team15			1
Team16			1
Team17		1	
Team18			1
Team19			1
Team20		1	
Team21			1
Team22			1
Team23			1
Team24			1
Team25		1	
Grand Total	1	7	17

Source: Own work.

Table 31: Participants using agile practices

Organisation	Team	No, and not really interested in using it	No, but interested in using it	Yes, a little	Yes, a lot
Org1	T1		1		
Org2	T2		2		
	T3		1		
	T13			3	
	T15	1	1		
	T19			1	
	T20		1		
	T9	1	1		

Org3	T4				2
Org4	T5				1
Org5	T6	1			
Org6	T7		1		
Org7	T8				1
Org8	T10				2
Org9	T11		2		
Org10	T12				1
Org11	T14	1	1		
Org12	T16	1			
Org13	T17				1
Org14	T18	1	1		
Org15	T21		1		
Org16	T22				1
Org17	T23			1	
Org18	T24		1		
Org19	T25		1		
Grand Total		6	15	5	9

Source: Own work.

Table 32: Agile methodology used by teams

Organisation	Team	Hybrid traditional and agile	Kanban	Scrum	N/A
Org1	T1				1
Org2	T2				2
	T3				1
	T13			3	
	T15				2
	T19	1			
	T20				1
	T9				2
Org3	T4			2	
Org4	T5	1			
Org5	T6				1
Org6	T7				1
Org7	T8	1			
Org8	T10			2	
Org9	T11				2
Org10	T12			1	
Org11	T14				2
Org12	T16				1
Org13	T17	1			
Org14	T18				2

Org15	T21				1
Org16	T22			1	
Org17	T23		1		
Org18	T24				1
Org19	T25				1
Grand Total		4	1	9	21

Source: Own work.

Table 33: Years of using agile management practices per team

Organisation	Team	0	1 – 2 years	3 – 5 years	6 – 10 years
Org2	T13			3	
	T19			1	
Org3	T4		1	1	
Org4	T5			1	
Org7	T8		1		
Org8	T10		1	1	
Org10	T12				1
Org13	T17			1	
Org16	T22	1			
Org17	T23		1		
Grand Total		1	4	8	1

Source: Own work.

Table 34: Frequency of using agile management practices

Organisation	Team	Always used	Almost always used	Frequently used	Occasionally used	Rarely used
Org2	T13			1	1	1
	T19				1	
Org3	T4		1	1		
Org4	T5		1			
Org7	T8				1	
Org8	T10			2		
Org10	T12	1				
Org13	T17			1		
Org16	T22				1	
Org17	T23			1		
Grand Total		1	2	6	4	1

Source: Own work.

Table 35: Usage of agile practices for managing projects

Organisation	Team	For all projects where applicable	For software development and occasionally for non-software projects	Only for software development
Org2	T13	2	1	
	T19		1	
Org3	T4	1		1
Org4	T5	1		
Org7	T8	1		
Org8	T10	1		1
Org10	T12			1
Org13	T17		1	
Org16	T22	1		
Org17	T23			1
Grand Total		7	3	4

Source: Own work.

Table 36: Reasons for the teams to adopt agile practices

Organization	Org 10	Org 13	Org 16	Org 17	Org 2		Org 3	Org 4	Org 7	Org 8	Total
Answer/team	T12	T17	T22	T23	T13	T19	T4	T5	T8	T10	
enhance ability to manage changing priorities	1	1		1	2		1		1	1	8
accelerate software delivery		1	1		1			1	1	2	7
increase productivity	1	1			3		1	1			7
reduce project risk	1		1	1				1	1		5
improve business/it alignment			1		2	1					4
better manage distributed teams					1		1		1		3
enhance software quality					1	1			1		3
improve project visibility	1				1						2

increase software maintainability					1				1	2
enhance delivery predictability					1					1

Table 37: Reasons for the participant to adopt agile practices

	Org10	Org13	Org16	Org17	Org2		Org3	Org4	Org7	Org8	Total
	T12	T17	T22	T23	T13	T19	T4	T5	T8	T10	
increase productivity	1	1	1		3		1	1			8
accelerate project delivery		1	1		2	1	1			1	7
improve business/it alignment				1	1	1			1	1	5
better manage distributed teams					1		2	1			4
enhance ability to manage changing priorities		1			1				1	1	4
reduce project risk		1	1						1		3
enhance software quality						1	1			1	3
enhance project quality					1					1	2
increase software maintainability							1			1	2
improve engineering discipline								1			1
improve project visibility				1							1
enhance delivery predictability	1										1
accelerate software delivery	1										1

Table 38: Benefits of adopting agile practices

	Org10	Org13	Org16	Org17	Org2		Org3	Org4	Org7	Org8	Total
	T12	T17	T22	T23	T13	T19	T4	T5	T8	T10	
increased team productivity	1	1	1		3	1	1	1		1	10
ability to manage changing priorities	1	1		1	2			1	1		7
delivery speed/time to market		1		1	1				1	2	6
software quality	1			1		1	1		1	1	6
project risk reduction			1		2				1		4
managing distributed teams					1		2	1			4
business/it alignment					1	1			1		3
project predictability	1						1			1	3
project visibility			1		1						2
software maintainability							1			1	2
project cost reduction	1										1
team morale								1			1

Source: Own work.

Table 39: Level of competency on agile maturity adoption for teams that are practicing agile

Row Labels	high	medium
Team4	1	
Team5	1	
Team8		1
Team10	1	
Team12	1	
Team13	1	
Team17		1
Team19	1	
Team22	1	
Team23	1	
Grand Total	8	2

Table 40: Level of competency on agile maturity adoption for teams that are non-agile

Teams	high	medium	low
Team1	1		
Team2		1	
Team3	1		
Team6			1
Team7	1		
Team9		1	
Team11		1	
Team14	1		
Team15	1		
Team16	1		
Team18	1		
Team20		1	
Team21	1		
Team24	1		
Team25		1	
Grand Total	9	5	1

Table 41: Working remotely and not required presence in the office

Organisation	Team	Yes, all the time	Yes, mostly	Yes, occasionally
Org1	T1	1		
Org2	T13	3		
	T15		2	
	T19	1		
	T2	1	1	
	T20		1	
	T3		1	
	T9		2	
Org3	T4		2	
Org4	T5	1		
Org5	T6		1	
Org6	T7			1
Org7	T8	1		
Org8	T10	1	1	
Org9	T11		2	
Org10	T12	1		
Org11	T14		2	
Org12	T16	1		

Org13	T17	1		
Org14	T18		2	
Org15	T21			1
Org16	T22	1		
Org17	T23	1		
Org18	T24		1	
Org19	T25	1		
Grand Total		15	18	2

Table 42: Working in an agile team that is not in the same location

Organisation	Team	No answer	Don't know	No	Yes
Org1	T1			1	
Org2	T13				3
	T15			2	
	T19	1			
	T2			1	1
	T20	1			
	T3		1		
	T9			1	1
Org3	T4				2
Org4	T5				1
Org5	T6			1	
Org6	T7				1
Org7	T8				1
Org8	T10				2
Org9	T11			2	
Org10	T12				1
Org11	T14			1	1
Org12	T16				1
Org13	T17				1
Org14	T18			1	1
Org15	T21				1
Org16	T22				1
Org17	T23				1
Org18	T24				1
Org19	T25			1	
Grand Total		2	1	11	21

Table 43: Knowing of other teams in their organization that is working remotely and not all members are in the same location

Organisation	Team	Don't know	No	Yes
Org1	T1			1
Org2	T13			3
	T15			2
	T19			1
	T2	1		1
	T20			1
	T3			1
	T9			2
Org3	T4		1	1
Org4	T5			1
Org5	T6		1	
Org6	T7			1
Org7	T8			1
Org8	T10			2
Org9	T11			2
Org10	T12			1
Org11	T14		1	1
Org12	T16			1
Org13	T17			1
Org14	T18	1		1
Org15	T21			1
Org16	T22			1
Org17	T23			1
Org18	T24			1
Org19	T25			1
Grand Total		2	3	30

Source: Own work.

Table 44: Using agile methods/practices before Covid-19 pandemic

Organisation	Team	No, and not really interested in using it	No, but interested in using it	Not Answered	Yes, a little	Yes, a lot
Org1	T1		1			
Org2	T13				3	
	T15	1	1			
	T19				1	
	T2		2			
	T20		1			

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Organisation	Team					
	T3		1			
	T9	1			1	
Org3	T4				1	1
Org4	T5					1
Org5	T6	1				
Org6	T7		1			
Org7	T8				1	
Org8	T10				1	1
Org9	T11		1	1		
Org10	T12					1
Org11	T14		1		1	
Org12	T16				1	
Org13	T17					1
Org14	T18	1			1	
Org15	T21		1			
Org16	T22				1	
Org17	T23				1	
Org18	T24		1			
Org19	T25				1	
Grand Total		4	11	1	14	5

Source: Own work.

Table 45: Covid-19 pandemic affected teams' adaption of agile methods/practices

Organisation	Team	No, and no real interest in using it	No, but raise interest in using it	No answer	Yes, the pandemic accelerated agile adaptation
Org1	T1	1			
Org2	T13				3
	T15	1	1		
	T19		1		
	T2		1		1
	T20		1		
	T3			1	
	T9	1			1
Org3	T4				2
Org4	T5		1		
Org5	T6		1		
Org6	T7		1		
Org7	T8		1		
Org8	T10				2
Org9	T11	1	1		
Org10	T12		1		
Org11	T14		1		1
Org12	T16		1		

Org13	T17				1
Org14	T18	1			1
Org15	T21		1		
Org16	T22		1		
Org17	T23				1
Org18	T24		1		
Org19	T25		1		
Grand Total		5	16	1	13

Source: Own work.